July, 1930

Railway Engineering and Maintenance

RAILWAY ENGINEERING AND MAINTENANCE
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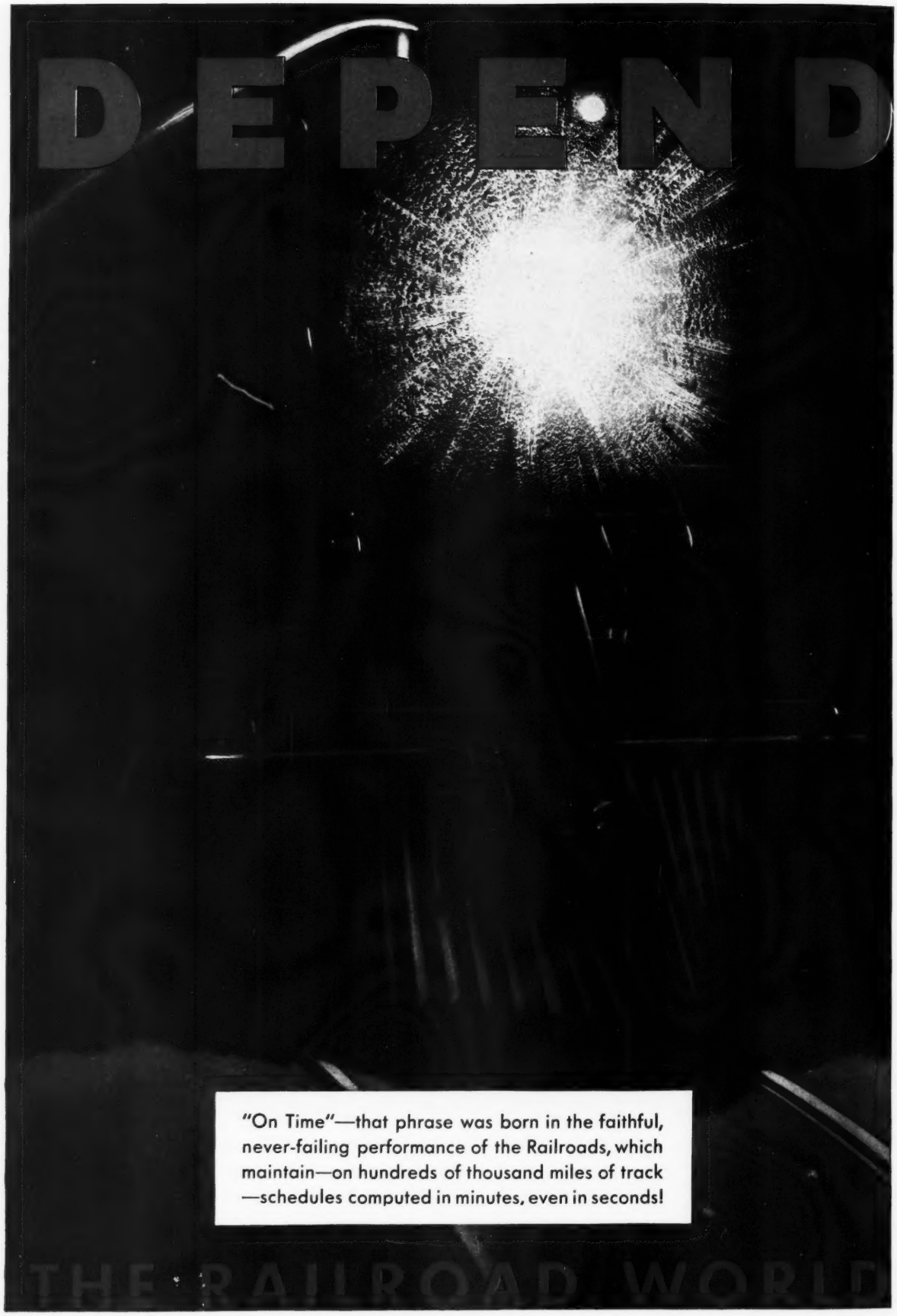
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"On Time"—that phrase was born in the faithful, never-failing performance of the Railroads, which maintain—on hundreds of thousand miles of track —schedules computed in minutes, even in seconds!
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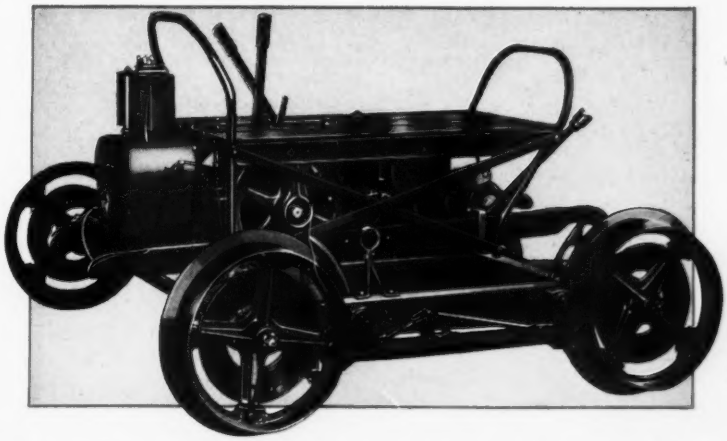

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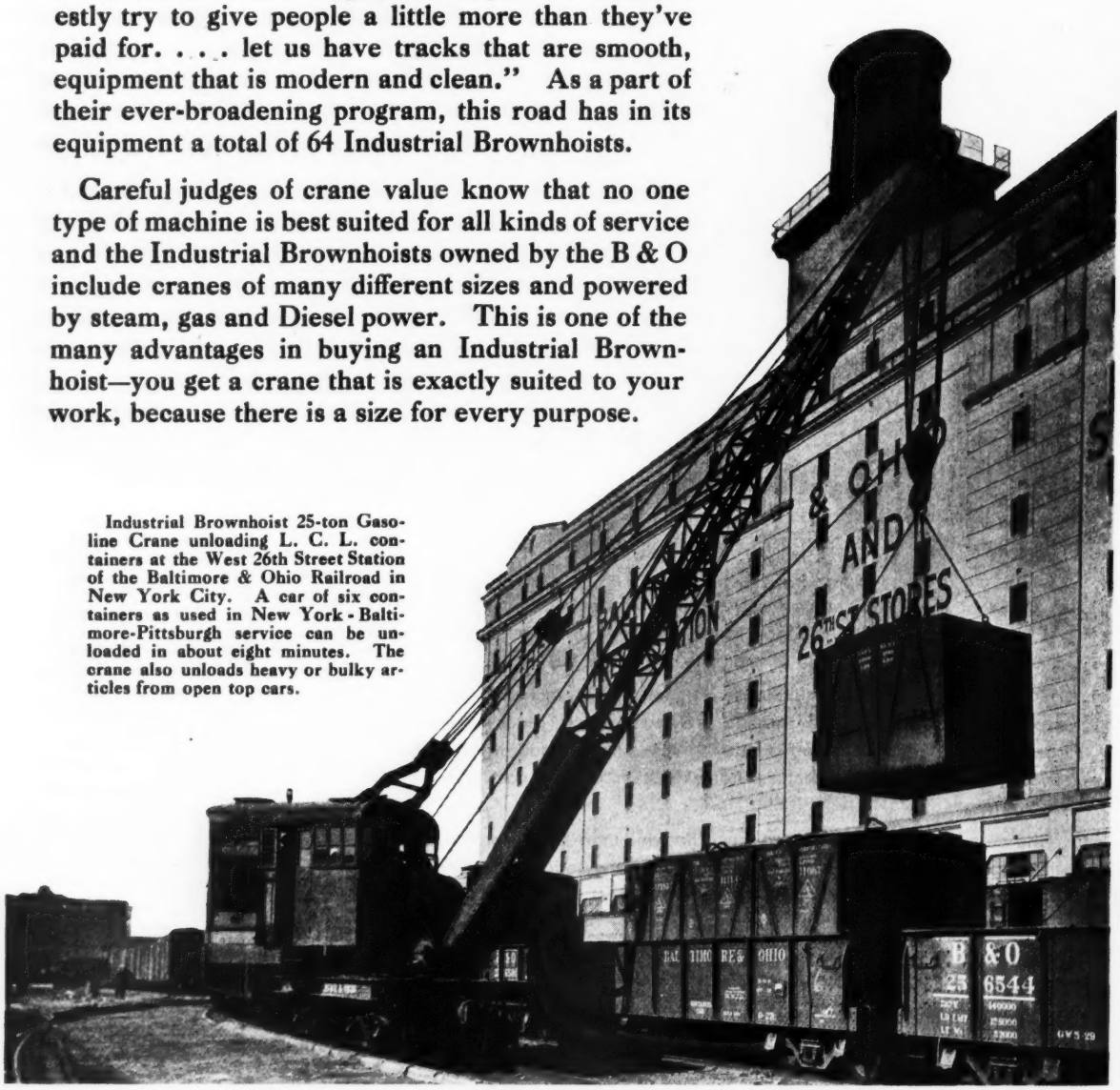

Industrial Brownhoist 25-ton Gasoline Crane unloading L. C. L. containers at the West 26th Street Station of the Baltimore & Ohio Railroad in New York City. A car of six containers as used in New York - Baltimore-Pittsburgh service can be unloaded in about eight minutes. The crane also unloads heavy or bulky articles from open top cars.

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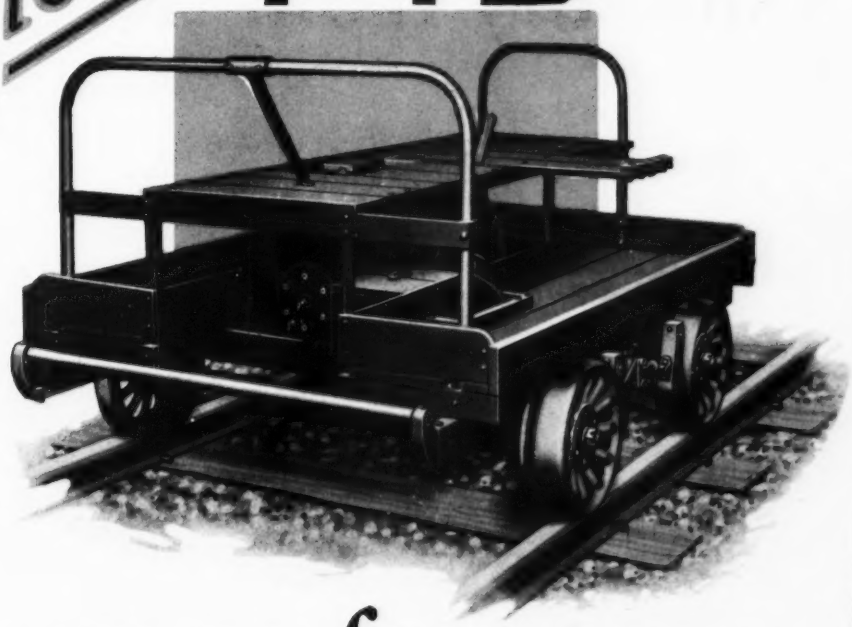

1930 begins the SECOND CENTURY of building FAIRBANKS SCALES

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is not built on "here and there" features

An improved fastening here. A sturdy bracing there. Commendable features, no doubt, but often given unwarranted prominence in selling motor cars. Experienced buyers know that *every part* of a railway motor car must be built as well as those "special" features or interrupted service and high maintenance costs will follow.

Sheffield Motor Cars, of course, have desirable and important construction characteristics. This is natural as "Sheffield" design—the result of over 34 years of experience—is far in advance of the field. Yet you are not urged to buy a "Sheffield" because of two or three "features."

Every part of the Sheffield Motor Car will stand the closest inspection as to design, material and workmanship. *Every part* is built to give maximum service. There is no compromise to price. No cheapened construction that needs to be covered up by drawing attention to minor refinements. Because "Sheffield" is soundly constructed *throughout*, it is the *lowest overall cost* car on the market.

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TIMKEN BEARING EQUIPPED

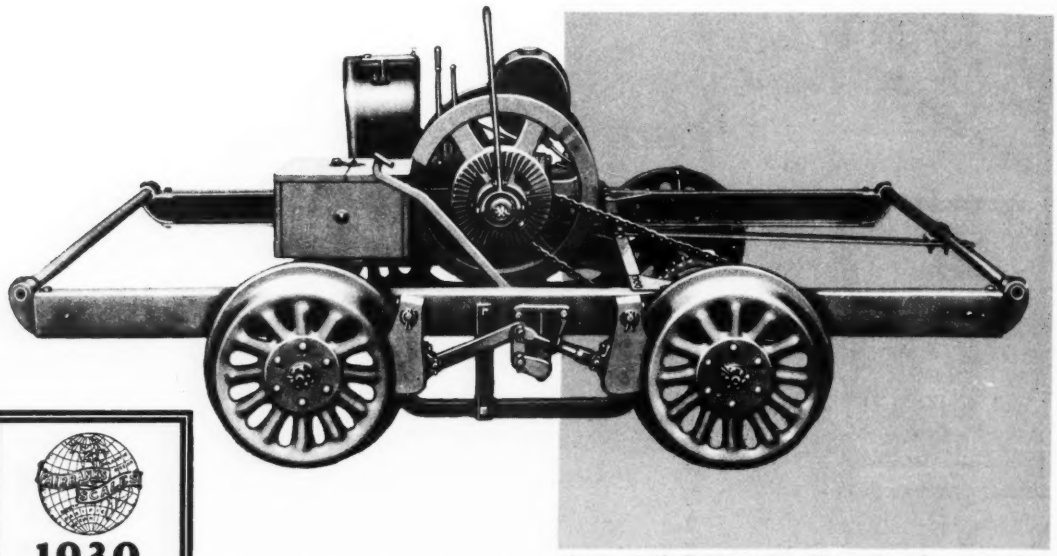
First on the rails... and still first

FAIRBANKS-MORSE

MOTOR CARS

POWER, PUMPING AND WEIGHING EQUIPMENT

Built *soundly* from the ground up



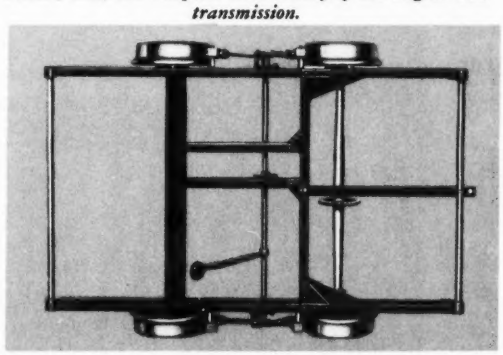
Chassis of Sheffield "44B," illustrating the strong but light steel frame and sturdy foundation for the engine. Notice, also, the complete accessibility of the engine and transmission.

1930
begins the
SECOND CENTURY
of building
FAIRBANKS SCALES

Railroad men have learned to expect more from Sheffield Motor Cars than from any other make—greater dependability, lower maintenance, longer life. Sheffield Railway Motor Cars set unparalleled performance standards because *every part* of these cars is built to give maximum service. There are no "weak links" in Sheffield construction.

Examine the frame of the Sheffield "44B," for example. This unit is made from special frame steel. The construction is similar to that used in automobiles—employing both die formed channel and tubular cross members. All frame members are carefully riveted. This type of construction provides flexibility with strength sufficient to withstand shocks that would demolish a wood frame, and it forever holds parts in proper alignment.

Every part of the Sheffield "44B" is built to the same high construction standard. Engine, clutch, transmission, body, brakes, axles, wheels—all play an important part in delivering the low cost performance which you can expect from every "Sheffield."



Top view of frame illustrating the heavy channels die pressed from special frame steel and the reinforcing gusset plates to brace the cross members.

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Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; stationary and marine oil engines; steam, power and centrifugal pumps; scales; motors and generators; complete coaling stations.

First on the rails...and still first

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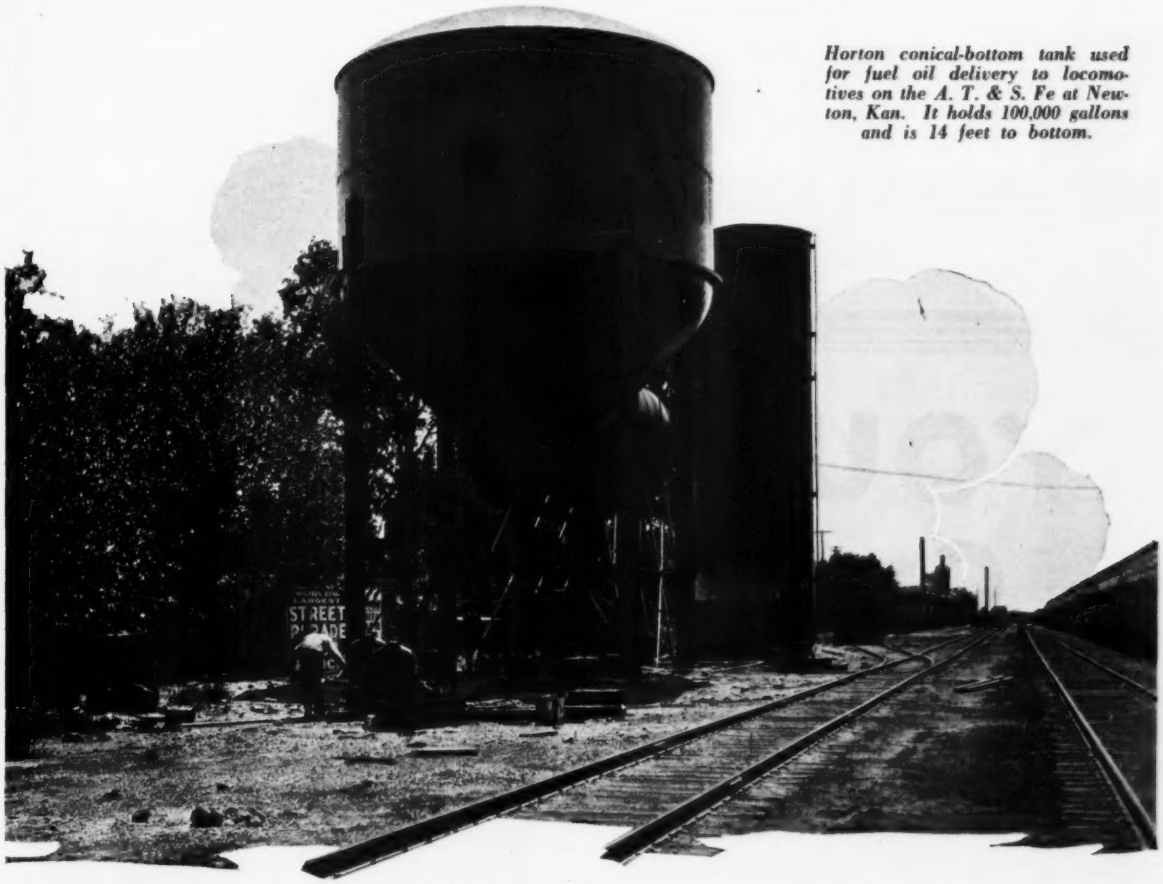
MOTOR CARS
POWER, PUMPING AND WEIGHING EQUIPMENT



Horton conical-bottom tank used for fuel oil delivery to locomotives on the A. T. & S. Fe at Newton, Kan. It holds 100,000 gallons and is 14 feet to bottom.

Steel tanks for fuel oil delivery

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Railway Engineering and Maintenance

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105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: BUSINESS CONDITIONS

June 26, 1930

Dear Reader:
Everywhere

The comments which I am now hearing so frequently among railway and particularly among railway supply men about present business conditions remind me of the nervous old lady who was making her first trip across the Atlantic Ocean and who, after several particularly stormy days, timidly approached one of the officers with the query, "Captain, will this storm ever cease?" To which he replied suavely, "They always have, my dear lady."

So it is in the present period of quiet business. It is true that railway traffic and railway net earnings are appreciably below those of last year. Yet the history of railway traffic shows that a sag invariably follows a record business like that of 1929.

We hear so much among railway supply men of the lack of orders from the railways now that we are likely to forget that the volume of business placed late last year and in the early weeks of this year was the largest in history. Our attention is called to a decline of $10,000,000 in maintenance of way expenditures in the first quarter of 1930 and we fail to appreciate that the expenditures for capital improvements for roadway in the same period exceeded those of a year ago by more than four times that amount.

The facts are that, like the old lady, our troubles are largely mental. Also they are in large part of our own making. The present slackening in business is due in no small measure to the fact that you and I and millions of others whose wages have not been cut have put off buying that suit of clothes or that new radio and are running the old car another year, with the result that the income of the men who make these materials is being reduced. It is of such an attitude that business depressions are made.

I am wondering if you and I are not largely responsible for the conditions of which we complain and if the remedy does not lie at least in part in our own hands.

Yours very truly,

Elmer T. Howson

ETH*MM

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of fastening used, and the fact that the number of loose bolts found of any one type varies almost directly with the tonnage passing over them. These observations point to the need for greater and more intelligent study of the loose bolt problem, for, as stated by Mr. Stimson, the period between the tightening of bolts is not seasonal or uniform for all sections of the road, but rather should be governed primarily by the density of traffic. In view of the magnitude and importance of this problem, these observations deserve careful consideration by maintenance of way men.

Keeping Bridges Clean

THE presence of dirt is the unfailing sign of poor housekeeping, whether it be noted in the home or factory. And poor housekeeping, in turn, is an evidence of poor management that probably has a more serious effect on the business involved than the mere matter of cleanliness. It is for this reason that officers of track maintenance are agreed that insistence on thorough policing of the right-of-way has a wholesome effect on the work of the track forces.

But the presence of dirt in many places has an even more direct influence on the upkeep of the property. On steel bridges, for example, it accelerates corrosion. Thus, the horizontal surfaces of highway bridges that form ready collecting places for street filth are invariably the first to show evidence of corrosion. Bridges carrying railway traffic are subject to deterioration from the same cause, and on one property it has been considered of enough importance to be the reason for a general order requiring that front-end cinders shall be swept off all bridges at regular intervals. Cinders are undoubtedly a more active agent in causing corrosion than most other materials that would naturally collect on a bridge, but the example is one that can be widely applied as a rule of good practice.

The Lowest Cost

FIGURES compiled recently by a large road which has given much attention to gang organization show that, with the same gang, it cost $100 more per mile to relay rail on a single-track line over which it was necessary to let trains pass than on an adjacent double-track division where it was possible to give the gang the undisturbed use of the track. In other words, this figure represented the added out-of-pocket cost of the work by reason of the necessity of providing for the movement of traffic, other conditions being essentially similar.

Such a figure is illuminating and should be used by maintenance and operating officers to determine how the interests of their road can best be served in the conduct of those operations that of necessity interfere with the movement of traffic. There are, of course, some lines on which trains are so frequent and of such a character that a track can be released only with the greatest difficulty and with much attendant confusion. There are other multiple-track lines on which trains are so infrequent or are so spaced that arrangements to give up the use of one track can be made with little difficulty. The conditions existing on the average road, however, lie somewhere between the two extremes. On such roads the taking of a track out of service does result in some interference with trains, although commonly less than anticipated. Such action, however, enables the track forces to complete their work and move on much more quickly and thus shorten the period of interruption so that it is doubtful if the total amount of interference to traffic is not less than when the work is extended by the necessity of closing up frequently to let trains over.

There is another and equally or more important consideration. This is the item of cost. As indicated in the opening sentence, much heavy maintenance work that interferes with the use of a track can normally be done for considerably less money where the forces are able to work continuously. This is so self-evident that elaboration is superfluous. Since the railway rather than any individual department must in the end pay the full cost of the work the final measure of cost should include all factors. It is not without significance that the practice of giving the maintenance of way department the use of a track for its major renewal operations is most common on those roads where the divisional rather than the departmental organization is in effect and where the superintendent shares the same responsibility for the economical conduct of maintenance of way as he does for transportation operations.

Protecting Railway Property

GRADE separation in cities has an incidental advantage in the obstacle it offers to trespassing. The elevation of tracks, particularly where the embankment is supported by retaining walls, makes it less convenient if not rather difficult for unauthorized persons to use the private property of the railway. The occasional trespasser, therefore, becomes conspicuous and is easily apprehended by railway special officers.

The situation is not greatly different in the case of track depression involving the use of retaining walls, although when the sides of the cut are on a natural slope, the necessity for climbing down the slope is probably less of a deterrent than the climb up an embankment, although the difference may be negligible. With either an embankment or a cut with natural side slopes, the protection is not complete and many roads have deemed it well worth while to provide high fences of the type designed to protect private property from intrusion. While the popularity of "hitch hiking" on the highways has greatly lessened trespassing on tracks, thievery and malicious mischief on railway property in cities is still a problem for railway police. Adequate fencing is a valuable aid in keeping unauthorized persons off the right-of-way.

Then and Now

"WE WILL not cut a weed on our railway this year," was the rather startling statement made by the chief maintenance of way officer of a prominent railway a few days ago. When pressed for an explanation he stated that the road was controlling weeds by the use of chemicals on ballasted main-line tracks and by burning elsewhere. He added further that following a recent inspection of the property by the president he was commended for its appearance.

A statement such as that quoted above is not novel except in the extent to which it indicates that manual weeding has been supplanted on this road. The destruction of weeds by the application of chemical poisons and by burning has been common practice for some time and has received increasing recognition year by year. The complete substitution of this method for the "man with the scuffle hoe" is, however, a commentary on the changes that are taking place in maintenance practices.

The weeding of track was long one of the principal tasks of track men, making serious inroads on their time at a season when other demands were heaviest. It also constituted one of the major charges against

track maintenance. Its necessity was largely taken for granted because weeds would grow, their presence was objectionable and the scuffle hoe was the one known agency for their removal. The work was slow, days being required for cleaning even a relatively short section. It was equally laborious, particularly under an August sun.

Now with the development of methods and equipment for the destruction of this growth by the newer agencies, short work is made of a single section and as much as 50 or 75 miles of track is cleaned in a single day with a force that is no larger than that in a single section gang. This is another indication of the progress that we are making in the elimination of drudgery from track work.

The Newer Form of Organization

NEVER before has so much thought been directed toward the form of organization of the track maintenance forces. For generations track maintenance has been built around the section gang, responsible for the day-to-day upkeep of a short section of track, supplemented by one or two gangs on each roadmaster's territory to do such heavy work as rail relaying and ballasting. In the days of the hand car the limits of the section were commonly fixed at five or six miles of single-track main line although following the introduction of the motor car there has been a tendency to lengthen sections, particularly on light-traffic branch lines. Other than this, however, the general form of organization has remained unchanged.

This has been true in spite of the fact that the character of the demands made on track forces have gradually changed. The installation of heavier rail, the addition of more and better ballast, more adequate drainage, etc., are indicative of ways in which the track structure has been strengthened and the amount of labor required for its upkeep reduced. Likewise, the use of treated ties and the adoption of the use of chemicals or burners for the destruction of weeds symbolize measures taken to reduce the amount of work to be done by section forces. As a result it has been possible on many roads to reduce the size of these gangs to a relatively limited number of men without affecting the standard of maintenance adversely.

During the last few years another influence has appeared. As labor-saving devices of one type after another have been perfected and their economy demonstrated, the roads have faced a new problem. If each section gang were to be provided with such equipment, the investment would be so large as, in many cases, to become prohibitive. Furthermore, by reason of the diversity of their duties, it is practical for a section gang to employ many such units for only limited periods, with the result that they are idle for the remainder of the time. On the other hand, to continue to do manually much of the work for which machinery is now available is admittedly uneconomic.

It is primarily to reconcile these conflicting considerations that a number of roads are turning to the specialized gangs. To such gangs, organized for specific tasks and concentrating on them, it is possible to turn over equipment designed to aid in such work with the knowledge that it will be used continuously and in a way that will yield the largest return. Furthermore, by organizing such a gang for a specific task the men become skilled in their respective operations and maximum output and minimum cost are secured.

Such measures are in the direction of economy and it is to be expected that they will be extended until they reach far into the scope of the activities of the section gangs as now constituted. In fact, it is not a far step to the time when the section force will be confined to one or two men to do the many minor tasks and much or most of the work now commonly assigned to section forces will be transferred to specialized gangs.

Using Tools Properly

AT THIS season of the year, when maintenance work is in full swing, tie renewals, ballasting, surfacing and the many other items which go to make up this operation as a whole are at their peak. This situation calls for the maximum use of the several types of tools which are required in the performance of the various tasks of track maintenance. While section and extra-gang foremen have a multitude of responsibilities in overseeing the work and assuring themselves that it is being done properly, there is one important duty that is often overlooked.

It is the duty of every foreman to know that his tools are in good condition and capable of doing the work for which they were designed. It is not difficult to secure good tools, so that there is little excuse for using one that is in poor condition. Tools that are being used should be inspected daily and the men forbidden to use those that are dull or out of repair. Tie tongs should be kept sharp so that they will not slip when in use. Much time may be lost and an unsatisfactory job may result from using dull adzes. Track chisels are nearly useless unless kept sharp and free from chipping. The use of spike mauls, sledges and track chisels that have rounded or burred faces or edges offers risk of personal injury.

The proper use of tools is another thing that should be supervised with care. They should be used only for the purpose for which they are intended. A claw bar is designed for pulling spikes and not for nipping ties. Lining bars can properly be used for lining track or nipping ties, but should never be substituted for a jack for the purpose of lifting the rail. Many foremen permit the use of shovels in pulling ties in and out. This not only opens the way for personal injuries but is certain to damage the new ties.

This list might be extended indefinitely and, if done, it would be found that the improper use of tools or the use of those that are dull or out of order, almost invariably opens the way to possible personal injury. Likewise, such practices are responsible for much unsatisfactory work and for added costs. It takes a relatively small amount of time to keep tools sharp and if the gang is properly organized and supervised the men will learn to use tools properly.

The C. N. R.'s "Continental Limited" at Bigger, Sask.

How the Canadian Battered

Satisfactory results are by its own force—

Making a Weld With the Welding Car Entirely in the Clear.

FOLLOWING experimental work in 1928, the Canadian Pacific has adopted the electric arc-welding method of building up battered rail ends on its high-speed main-line tracks, and within a few months time during the first half of 1929, the eastern lines of that road rehabilitated about 65 miles of track by that method. Starting in April, 1928, with one machine and only four men experienced in making rail welds, the eastern lines of the Canadian Pacific, by the early part of last year, had nine complete welding and grinding outfits at work in the hands of 36 skilled welders, who were developed from its regular track forces. So satisfactory was the welding work done that the road plans to continue this method of building up battered rail ends on an increased scale during 1930.

As a result of the experience gained during 1928, the Canadian Pacific undertook its work during 1929 with equipment which was specially adapted for the task. Each of the nine outfits consisted essentially of an electric welding and grinding car, especially designed for track work; a new type of carriage-mounted rail grinder for the heavy grinding; and a small electrically-operated hand grinder used in finishing-up work.

New Features in Welding Unit

The electric welding car used is the Wilson Welder and Metals Company's unit, which was described in *Railway Engineering and Maintenance* for September, 1928, page 398. This unit is powered by a Continental gasoline engine coupled to a generator of adequate capacity to furnish power for driving the car, and for welding and lighting. Direct-connected to the 300-amp. welding generator is a smaller 110-volt 3½-kw. generator for operating the grinders and floodlights. A new feature in connection with this latter unit is the provision of a circuit-breaker to prevent damage to the electrical equipment in the event that the generator is overloaded by crowding the grinding wheel in the grinding operations.

The welding car is equipped with transverse derailing wheels so that it can be set off readily along the right-of-way, and is provided with sufficient cable to permit welding operations to extend over a distance of 1,200 ft. at one setting. The power lines include 1,200 ft. of 4/0, extra-flexible covered cable, 600 ft. in the electrode line and 600 ft. in the ground line; 600 ft. of No. 6 twin-conductor to the main grinder unit; and 200 ft. of No. 2 extra-flexible cable to the portable hand grinder. For convenience in handling the heavy cable, the two 600-ft. lines of 4/0 cable are divided into 150-ft. lengths and are provided with 10-ft. sections at their work ends, one to the electrode holder and the other to the ground connection. For the same reason, the twin conductor to the large grinder is broken into three 200-ft. lengths.

New Type Grinder Developed

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The grinder-car frame consists mainly of two, two-part end castings, spaced 44 in. apart, which are mounted on double-flanged wheels and tied together by solid steel tie rods and seamless steel tubing. The upper part of the car frame, which has a pivoted connection to the lower part of the frame, carries the grinder carriage, which, in turn, supports all of the operating mechanisms, including a 3-hp., 110-volt,

Pacific Arc-Welds Rail Ends

secured with special equipment
New grinder a feature

A Welding Gang at Work on the Canadian Pacific

d.c. grinder motor, a 14-in by 3½-in. grinding wheel and the control switch; the grinding wheel being suspended directly over and in line with the rail. This carriage is capable of movement forward and backward along the rail through a distance of 30 in. between the end frames of the car, and the grinding wheel is thus passed forward and backward over the rail through this distance. Movement of the carriage is effected by a hand-operated screw drive.

In addition to the movement of the grinding wheel along the top of the rail, it can be moved laterally across the rail head, raised and lowered, and tilted to both sides to enable the shaping of the welded rail head to the proper contour of the rail section. The lateral and vertical movements of the grinding wheel are effected by hand-operated screws on the grinder carriage itself, while the tilting action is effected by a worm and gear movement at one end of the car frame, which tilts the entire upper half of the frame above its pivoted connection with the lower half of the frame. Locking levers at each end hold the upper part of the frame, and thereby, the grinder carriage and grinding wheel, at any desired angle of tilt while grinding is under way.

When moved over a considerable distance, the grinder car is made self-supporting in an upright position by a diagonal arm carrying a third flanged wheel, which operates on the opposite rail of the track. During the day's grinding operations, however, this supporting arm is dispensed with and the car is held erect and moved from joint to joint by two men. During actual grinding at a joint, the car is held in a vertical position by four screw standing posts, one at each corner, which can be turned down to bearings on the ties or on temporary blocking carried with the equipment. The unit is equipped with four lifting handles, and, as its operating weight is only 475 lb., it can be readily set off the track when not in use, or when it is necessary to clear for trains.

The small grinder used in connection with the work is a Black & Decker, No. 6, electrically-operated hand machine. This unit is equipped with 6-in. by ⅛-in. and 6-in. by 1-in. grinding wheels, and is used primarily for dressing up the gage side of the weld and for chamfering the weld material in the expansion space between rail ends.

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In the program for building-up battered rail ends during 1929, heavy traffic portions of main line track were undertaken first, and all joints with a batter in excess of 3/64 in. were built up. During the work, the welding outfits were kept in service two shifts each day. Six of the outfits were operated in pairs, while the other three were operated separately. The normal force with each outfit included a welder and a welder foreman, who alternated in welding, and two helpers, experienced in the operation of the grinders. When the outfits were operated in pairs opposite each other in double-track territory, only one foreman was employed for the two gangs.

In double-track territory, the outfits were spaced 1,200 ft. apart, each gang covering a section of track 600 ft. each side of the point where its welding car was set off. In automatic block-signal territory, all welding was confined to one rail at a time to avoid the possibility of set-

7

Railway
Engineering and Maintenance

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Renewal or Reinforcement—Which?

WHETHER a steel bridge of limited capacity should be replaced or strengthened depends upon a variety of considerations, and the relative weights given these may lead to what may seem to be a wide variation in policy. Even in the case where a span is actually replaced by a new one, the disposition of the old span may take several forms. It may be scrapped, it may be re-erected without change on a branch line of light traffic, or it may be installed on a line of somewhat heavier traffic after having been reinforced. Therefore, between the strengthening of a span in its original location, on the one hand, and its renewal and scrapping, on the other hand, there are a number of possibilities, the adoption of any one of which admits of considerable exercise of personal opinion.

However, even if it is the rule to carry out reinforcement work only on the exceptional structures because of the conviction that reinforcement necessarily results in a patchwork job, it may be advisable in some cases to strengthen an old bridge in spite of the fact that the cost may seem unwarranted compared with the cost of a new span. A not infrequent situation justifying extensive reinforcement rather than renewal is that imposed in the case of old spans in a bridge over a navigable stream. Application for the necessary authority from the government for a new structure may give rise to more severe requirements as to span length, with the result that the substructure as well as the superstructure must be replaced, and the bridge which must be built to meet these requirements will be far more expensive than the new bridge originally contemplated. Such a situation could easily justify expenditures for what might otherwise be deemed an unwarranted effort to retain an old bridge in service.

A situation of a different character is imposed in the case of a bridge located on a section of line where a change of grade or alinement is contemplated. Until this change is authorized, it would be a waste of money to rebuild the bridge if it were possible to retain the old structure in service, even at a considerable outlay. However, the elaborate provisions made for reinforcing bridges under circumstances like those cited above must not be taken as precedents for the strengthening of a bridge where special considerations are not involved. It is well to remember that the pound price for steel added or applied to an old span is many times more than the pound price of steel in a new structure.

Another Achievement

In the first three months of 1930 the railways burned 134 lb. of coal for every thousand tons of freight and equipment moved one mile. In the corresponding period of 1929, they consumed 139 lb. for a similar service and in 1923, 186 lb. In passenger service the railways burned 16.0 lb. of coal in moving a passenger car one mile as compared with 16.4 in the first quarter last year and 20.7 lb. in 1923. These figures show reductions of 28 per cent and 20 per cent in fuel consumed per unit of work performed in freight and passenger service, respectively, in seven years. Based on the traffic actually handled in 1930, they represent a saving of 9,612,453 tons of coal which, at the average price paid this year, amounts to $22,589,000, or nearly one-sixth of the total railway net earnings for the period.

Traffic Density and Loose Bolts

THAT traffic is the most important factor in producing loose track bolts is common knowledge among maintenance men, but relatively few appreciate the exact relationship existing between this troublesome item of maintenance work and the amount of traffic passing over the track. The nearest approach to anything definite in this regard in the past has been obtained from the general observation, that the heavier the traffic, the stronger the track structure must be, and usually the more intensive the maintenance put upon it. Lacking more definite knowledge, many roads largely disregard the traffic factor in other than a general way, and as a result follow practices of questionable value with regard to keeping bolts tight—the first requisite to properly maintained joints.

Each division or corresponding section of the road is allowed to formulate its own program. Supervisors or roadmasters are required to see that their tracks are gone over periodically to tighten loose bolts, and usually all of the foremen under one supervisor or roadmaster, and sometimes, all of the foremen on a division, are required to tighten bolts on certain days, regardless of the character of their track and the tonnage handled over it. No doubt, that is the simplest way of disposing of the matter, and to be sure, as a result, there will be certain days of the year when all of the track bolts are tight. The question is, however, whether that is the most effective and economical practice.

In an attempt to throw light on this subject, and incidentally, upon the merits of various joint fastenings, the Baltimore & Ohio is making some interesting tests. As stated in a paper presented before the Metropolitan Track Supervisors' Club recently by Earl Stimson, chief engineer maintenance of that road, observations of these test installations up to the present time disclose two important things; the magnitude of the loose-bolt problem in heavy-traffic territory, almost regardless of the type

of fastening used, and the fact that the number of loose bolts found of any one type varies almost directly with the tonnage passing over them. These observations point to the need for greater and more intelligent study of the loose bolt problem, for, as stated by Mr. Stimson, the period between the tightening of bolts is not seasonal or uniform for all sections of the road, but rather should be governed primarily by the density of traffic. In view of the magnitude and importance of this problem, these observations deserve careful consideration by maintenance of way men.

Keeping Bridges Clean

THE presence of dirt is the unfailing sign of poor housekeeping, whether it be noted in the home or factory. And poor housekeeping, in turn, is an evidence of poor management that probably has a more serious effect on the business involved than the mere matter of cleanliness. It is for this reason that officers of track maintenance are agreed that insistence on thorough policing of the right-of-way has a wholesome effect on the work of the track forces.

But the presence of dirt in many places has an even more direct influence on the upkeep of the property. On steel bridges, for example, it accelerates corrosion. Thus, the horizontal surfaces of highway bridges that form ready collecting places for street filth are invariably the first to show evidence of corrosion. Bridges carrying railway traffic are subject to deterioration from the same cause, and on one property it has been considered of enough importance to be the reason for a general order requiring that front-end cinders shall be swept off all bridges at regular intervals. Cinders are undoubtedly a more active agent in causing corrosion than most other materials that would naturally collect on a bridge, but the example is one that can be widely applied as a rule of good practice.

The Lowest Cost

FIGURES compiled recently by a large road which has given much attention to gang organization show that, with the same gang, it cost $100 more per mile to relay rail on a single-track line over which it was necessary to let trains pass than on an adjacent double-track division where it was possible to give the gang the undisturbed use of the track. In other words, this figure represented the added out-of-pocket cost of the work by reason of the necessity of providing for the movement of traffic, other conditions being essentially similar.

Such a figure is illuminating and should be used by maintenance and operating officers to determine how the interests of their road can best be served in the conduct of those operations that of necessity interfere with the movement of traffic. There are, of course, some lines on which trains are so frequent and of such a character that a track can be released only with the greatest difficulty and with much attendant confusion. There are other multiple-track lines on which trains are so infrequent or are so spaced that arrangements to give up the use of one track can be made with little difficulty. The conditions existing on the average road, however, lie somewhere between the two extremes. On such roads the taking of a track out of service does result in some interference with trains, although commonly less than anticipated. Such action, however, enables the track forces to complete their work and move on much more quickly and thus shorten the period of interruption so that it is doubtful if the total amount of interference to traffic is not less than when the work is extended by the necessity of closing up frequently to let trains over.

There is another and equally or more important consideration. This is the item of cost. As indicated in the opening sentence, much heavy maintenance work that interferes with the use of a track can normally be done for considerably less money where the forces are able to work continuously. This is so self-evident that elaboration is superfluous. Since the railway rather than any individual department must in the end pay the full cost of the work the final measure of cost should include all factors. It is not without significance that the practice of giving the maintenance of way department the use of a track for its major renewal operations is most common on those roads where the divisional rather than the departmental organization is in effect and where the superintendent shares the same responsibility for the economical conduct of maintenance of way as he does for transportation operations.

Protecting Railway Property

GRADE separation in cities has an incidental advantage in the obstacle it offers to trespassing. The elevation of tracks, particularly where the embankment is supported by retaining walls, makes it less convenient if not rather difficult for unauthorized persons to use the private property of the railway. The occasional trespasser, therefore, becomes conspicuous and is easily apprehended by railway special officers.

The situation is not greatly different in the case of track depression involving the use of retaining walls, although when the sides of the cut are on a natural slope, the necessity for climbing down the slope is probably less of a deterrent than the climb up an embankment, although the difference may be negligible. With either an embankment or a cut with natural side slopes, the protection is not complete and many roads have deemed it well worth while to provide high fences of the type designed to protect private property from intrusion. While the popularity of "hitch hiking" on the highways has greatly lessened trespassing on tracks, thievery and malicious mischief on railway property in cities is still a problem for railway police. Adequate fencing is a valuable aid in keeping unauthorized persons off the right-of-way.

Then and Now

"WE WILL not cut a weed on our railway this year," was the rather startling statement made by the chief maintenance of way officer of a prominent railway a few days ago. When pressed for an explanation he stated that the road was controlling weeds by the use of chemicals on ballasted main-line tracks and by burning elsewhere. He added further that following a recent inspection of the property by the president he was commended for its appearance.

A statement such as that quoted above is not novel except in the extent to which it indicates that manual weeding has been supplanted on this road. The destruction of weeds by the application of chemical poisons and by burning has been common practice for some time and has received increasing recognition year by year. The complete substitution of this method for the "man with the scuffle hoe" is, however, a commentary on the changes that are taking place in maintenance practices.

The weeding of track was long one of the principal tasks of track men, making serious inroads on their time at a season when other demands were heaviest. It also constituted one of the major charges against

track maintenance. Its necessity was largely taken for granted because weeds would grow, their presence was objectionable and the scuffle hoe was the one known agency for their removal. The work was slow, days being required for cleaning even a relatively short section. It was equally laborious, particularly under an August sun.

Now with the development of methods and equipment for the destruction of this growth by the newer agencies, short work is made of a single section and as much as 50 or 75 miles of track is cleaned in a single day with a force that is no larger than that in a single section gang. This is another indication of the progress that we are making in the elimination of drudgery from track work.

The Newer Form of Organization

NEVER before has so much thought been directed toward the form of organization of the track maintenance forces. For generations track maintenance has been built around the section gang, responsible for the day-to-day upkeep of a short section of track, supplemented by one or two gangs on each roadmaster's territory to do such heavy work as rail relaying and ballasting. In the days of the hand car the limits of the section were commonly fixed at five or six miles of single-track main line although following the introduction of the motor car there has been a tendency to lengthen sections, particularly on light-traffic branch lines. Other than this, however, the general form of organization has remained unchanged.

This has been true in spite of the fact that the character of the demands made on track forces have gradually changed. The installation of heavier rail, the addition of more and better ballast, more adequate drainage, etc., are indicative of ways in which the track structure has been strengthened and the amount of labor required for its upkeep reduced. Likewise, the use of treated ties and the adoption of the use of chemicals or burners for the destruction of weeds symbolize measures taken to reduce the amount of work to be done by section forces. As a result it has been possible on many roads to reduce the size of these gangs to a relatively limited number of men without affecting the standard of maintenance adversely.

During the last few years another influence has appeared. As labor-saving devices of one type after another have been perfected and their economy demonstrated, the roads have faced a new problem. If each section gang were to be provided with such equipment, the investment would be so large as, in many cases, to become prohibitive. Furthermore, by reason of the diversity of their duties, it is practical for a section gang to employ many such units for only limited periods, with the result that they are idle for the remainder of the time. On the other hand, to continue to do manually much of the work for which machinery is now available is admittedly uneconomic.

It is primarily to reconcile these conflicting considerations that a number of roads are turning to the specialized gangs. To such gangs, organized for specific tasks and concentrating on them, it is possible to turn over equipment designed to aid in such work with the knowledge that it will be used continuously and in a way that will yield the largest return. Furthermore, by organizing such a gang for a specific task the men become skilled in their respective operations and maximum output and minimum cost are secured.

Such measures are in the direction of economy and it is to be expected that they will be extended until they reach far into the scope of the activities of the section gangs as now constituted. In fact, it is not a far step to the time when the section force will be confined to one or two men to do the many minor tasks and much or most of the work now commonly assigned to section forces will be transferred to specialized gangs.

Using Tools Properly

AT THIS season of the year, when maintenance work is in full swing, tie renewals, ballasting, surfacing and the many other items which go to make up this operation as a whole are at their peak. This situation calls for the maximum use of the several types of tools which are required in the performance of the various tasks of track maintenance. While section and extra-gang foremen have a multitude of responsibilities in overseeing the work and assuring themselves that it is being done properly, there is one important duty that is often overlooked.

It is the duty of every foreman to know that his tools are in good condition and capable of doing the work for which they were designed. It is not difficult to secure good tools, so that there is little excuse for using one that is in poor condition. Tools that are being used should be inspected daily and the men forbidden to use those that are dull or out of repair. Tie tongs should be kept sharp so that they will not slip when in use. Much time may be lost and an unsatisfactory job may result from using dull adzes. Track chisels are nearly useless unless kept sharp and free from chipping. The use of spike mauls, sledges and track chisels that have rounded or burred faces or edges offers risk of personal injury.

The proper use of tools is another thing that should be supervised with care. They should be used only for the purpose for which they are intended. A claw bar is designed for pulling spikes and not for nipping ties. Lining bars can properly be used for lining track or nipping ties, but should never be substituted for a jack for the purpose of lifting the rail. Many foremen permit the use of shovels in pulling ties in and out. This not only opens the way for personal injuries but is certain to damage the new ties.

This list might be extended indefinitely and, if done, it would be found that the improper use of tools or the use of those that are dull or out of order, almost invariably opens the way to possible personal injury. Likewise, such practices are responsible for much unsatisfactory work and for added costs. It takes a relatively small amount of time to keep tools sharp and if the gang is properly organized and supervised the men will learn to use tools properly.

The C. N. R.'s "Continental Limited" at Bigger, Sask.

How the Canadian Battered

Satisfactory results are by its own force—

Making a Weld With the Welding Car Entirely in the Clear.

FOLLOWING experimental work in 1928, the Canadian Pacific has adopted the electric arc-welding method of building up battered rail ends on its high-speed main-line tracks, and within a few months time during the first half of 1929, the eastern lines of that road rehabilitated about 65 miles of track by that method. Starting in April, 1928, with one machine and only four men experienced in making rail welds, the eastern lines of the Canadian Pacific, by the early part of last year, had nine complete welding and grinding outfits at work in the hands of 36 skilled welders, who were developed from its regular track forces. So satisfactory was the welding work done that the road plans to continue this method of building up battered rail ends on an increased scale during 1930.

As a result of the experience gained during 1928, the Canadian Pacific undertook its work during 1929 with equipment which was specially adapted for the task. Each of the nine outfits consisted essentially of an electric welding and grinding car, especially designed for track work; a new type of carriage-mounted rail grinder for the heavy grinding; and a small electrically-operated hand grinder used in finishing-up work.

New Features in Welding Unit

The electric welding car used is the Wilson Welder and Metals Company's unit, which was described in *Railway Engineering and Maintenance* for September, 1928, page 398. This unit is powered by a Continental gasoline engine coupled to a generator of adequate capacity to furnish power for driving the car, and for welding and lighting. Direct-connected to the 300-amp. welding generator is a smaller 110-volt 3½-kw. generator for operating the grinders and floodlights. A new feature in connection with this latter unit is the provision of a circuit-breaker to prevent damage to the electrical equipment in the event that the generator is overloaded by crowding the grinding wheel in the grinding operations.

The welding car is equipped with transverse derailing wheels so that it can be set off readily along the right-of-way, and is provided with sufficient cable to permit welding operations to extend over a distance of 1,200 ft. at one setting. The power lines include 1,200 ft. of 4/0, extra-flexible covered cable, 600 ft. in the electrode line and 600 ft. in the ground line; 600 ft. of No. 6 twin-conductor to the main grinder unit; and 200 ft. of No. 2 extra-flexible cable to the portable hand grinder. For convenience in handling the heavy cable, the two 600-ft. lines of 4/0 cable are divided into 150-ft. lengths and are provided with 10-ft. sections at their work ends, one to the electrode holder and the other to the ground connection. For the same reason, the twin conductor to the large grinder is broken into three 200-ft. lengths.

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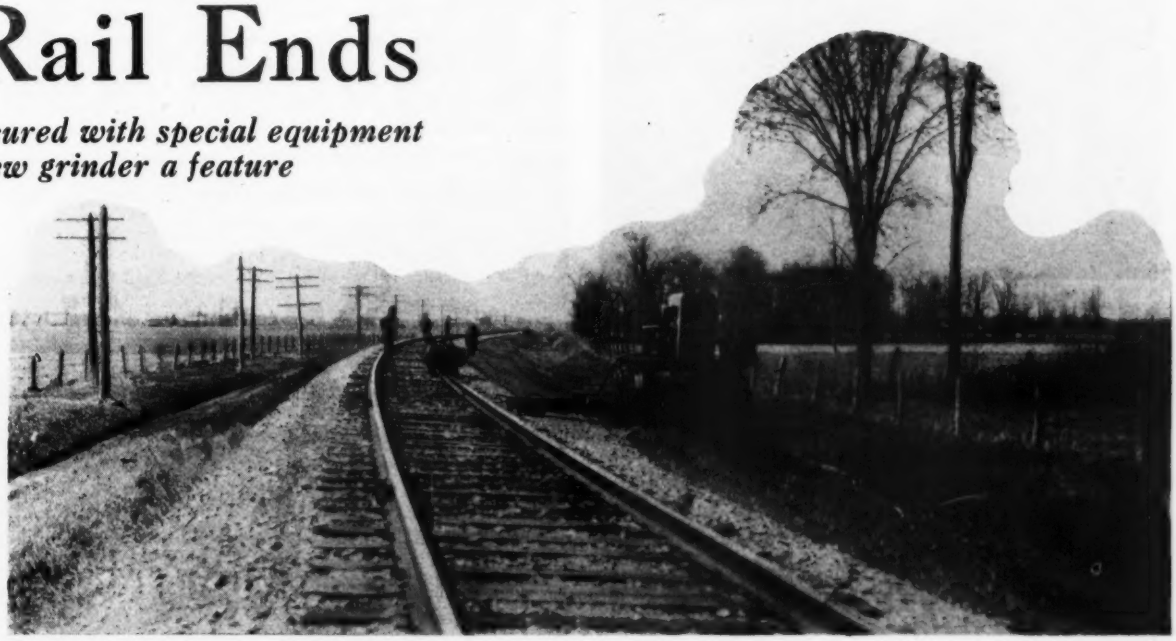

A Welding Gang at Work on the Canadian Pacific

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In double-track territory, the outfits were spaced 1,200 ft. apart, each gang covering a section of track 600 ft. each side of the point where its welding car was set off. In automatic block-signal territory, all welding was confined to one rail at a time to avoid the possibility of set-

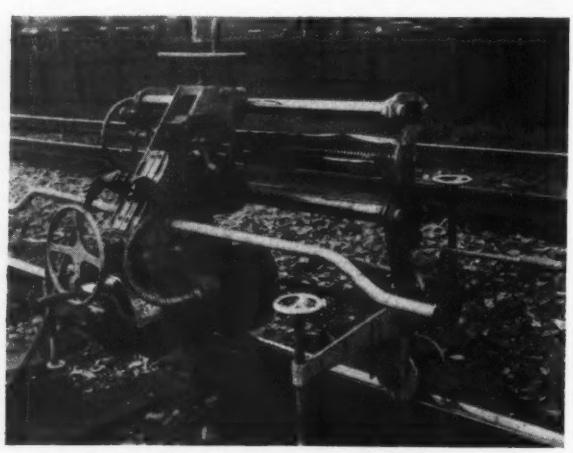
A Welder at Work, While a Man With a Portable Grinder Is Finishing Up Last Weld Completed

ting up false signal indications. The two shifts, which were employed in the welding operations to speed up the progress of the work, extended from 3 a. m. to 9 p. m., as desired by the men, the night operations being carried out by the aid of electric floodlights, moved along as the work progressed.

About 25 Minutes Required to the Joint

All of the work was done under traffic, under slow-order protection, restricting the speed of trains to 20 mi. per hr. In the actual work, the welder foreman first determined the extent of the batter at each joint with a 22-in. straight edge. The welding was then done by applying the metal in longitudinal beads along the head of the rail, continuous across the expansion space between rails unless this was too wide. The method of making the welds was not unusual, except that a five-per cent nickel-steel flux-coated rod, 5/32 in. in diameter, was used, and was applied by a current of 150 amp. open-circuit voltage. One precaution was to attach a ground clamp directly to the rail at the joint being welded to avoid signal disturbances. No difficulty was experienced from this source, as the clamp used was wedged onto the base of the rail, and did not have to be moved or disturbed during the passing of trains.

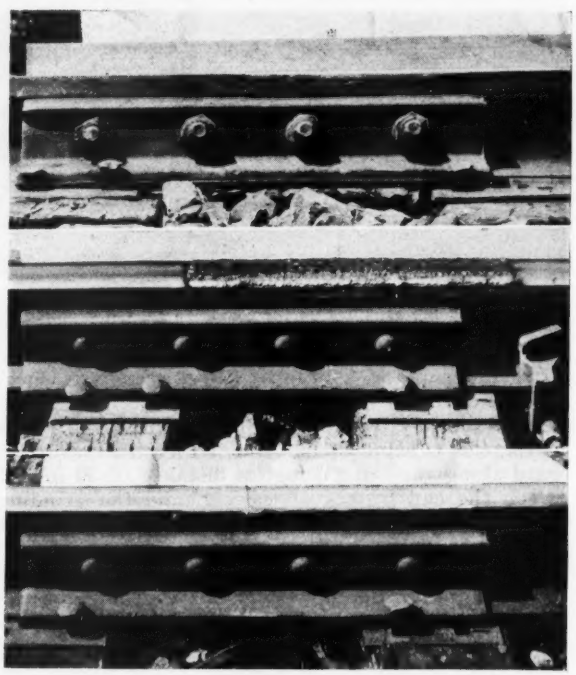
As soon as a weld was completed, which required an average of about fifteen minutes, or upon the completion of several welds, the large grinder unit was set up and the weld was ground down to the contour of the rail at the ends of the weld. Following this, the small portable grinder, with its 1/8-in. wheel, chamfered down through the weld at the rail ends to provide a clean-cut normal expansion space. This small grinder was also used with a one-inch wheel to dress-up the gage side of the rail head where this was necessary. The actual time required in the grinding work at a joint averaged about ten minutes, so that the total working time required to rebuild the rail ends at a joint was about twenty-five minutes. On one stretch of track, each outfit, working two shifts a day, completed an average of 18 joints each shift, in spite of repeated interruptions by trains. The average weld made was about 17 to 18 in. in length.



The New Type of Rail Grinder in Grinding Position Over a Weld

High Class Welds Were Secured

An unusually high quality of welds has been secured, using a 5 per cent nickel-steel, flux-coated rod, applied with a current of 150 amp. at 60 volts. This combination not only resulted in sound welds, but proved most satisfactory from the standpoint of the ease with which the material could be applied and the speed with which the welds could be made.



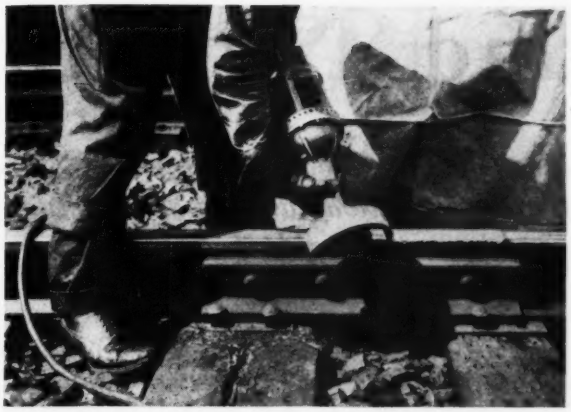
Three Stages in Rebuilding Rail Ends

Above—Severely battered rail at a joint. Center—A completed electric weld ready for grinding. Below—The refinished rail ends after grinding

Tests with the scleroscope indicated that the welds had a scleroscope hardness rating of about 55 immediately after being completed, and that this increased under traffic to from 60 to 63 in a few months time, which is equivalent to a Brinell hardness of about 380.

The foreman of each welding gang was required to send in a weekly report of the number of welds made and the time and materials used. Each welder was also given a number indication which he was required to punch in the side of each weld which he made. Through these methods, close check was kept on the cost of the work, and each welder was made definitely responsible for the character of his own welds. That satisfactory results were effected is evidenced by the fact that the cost of the welding steadily decreased as the men became more expert in the work, and by the further fact that examination of the rebuilt rail ends after 16 months' service, showed them to be in good condition.

In a continuation of the welding work it is planned



Smoothing Up the Gage Side of a Weld With a Portable Grinder

to start building up rail ends early in the spring on a two-shift basis, and to continue this through the summer and into the late fall. During the winter it is planned to cut the operations to day work only and to confine the welding mainly to the building up of special track work, such as frogs and switches.

All of the work described was carried out under the direction of the divisional organization and under the supervision of A. C. Mackenzie, engineer maintenance of way, eastern lines.

Searching for Water*

By J. R. Hickox

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IN LOOKING for a supply of water, the same rule holds as when searching for gold—it is where you find it—and no one can say positively that by doing certain things a supply will be had, or that a supply cannot be had by following certain other methods. However, there are certain basic principles that eliminate some of the uncertainties.

In a general way, the earth's crust is made up of layers placed upon each other in a known order of succession. Each one of these layers has its characteristic minerals, as to both kind and quantity, so that if we can identify the stratum exposed on the surface at the desired location for a water station, we can obtain a fairly accurate idea of the strata below, and with this information at hand we are in a position to decide with reasonable accuracy whether the best supply can be had from wells, streams, or impounded surface water. The water that falls on the earth in the form of rain and snow is nearly pure, and the objectionable salts of lime, magnesia and soda that we afterwards find in our supplies are picked up by contact with the ground, either by flowing over it or leaching through it.

A knowledge of the geology of the locality is of great assistance in determining where to look for the best supply. Sometimes by moving a comparatively short distance to higher ground an entirely different quality of water can be found. I can call to mind valleys formed by erosion through shales, where water derived from wells is unfit for boiler use, even after treatment, but on higher ground nearby there are gravel beds lying above the shale that contain water of excellent quality. In other places where the surface formation is full of gypsum and surface water is, therefore, high in sulphate hardness, we can obtain a soft sodium carbonate water by drilling a well through this formation into a lower one.

One does not have to be a geologist to solve these problems. A vast amount of valuable information along this line is now available in reports compiled by the United States Geological Survey and the geological departments of the various states, and I have found this information to be of great assistance. Whatever the sources investigated, representative samples should be taken and analyzed. Nothing should be left to chance in making the selection.

Storage Reservoirs

Storage reservoirs as a source of water supply are seldom resorted to except where a good supply cannot be had from either wells or running streams, principally because of the high initial cost. But nearly all the large western railroads find this source of supply necessary on some parts of their systems. Where rains are as frequent and abundant as they are east of the Missouri river, it is not a difficult matter to design works of this kind, but when we get into what was once called the "Great American desert," it is different.

It is desirable that the surface area of a reservoir be as small as possible in proportion to the capacity, to keep down the loss by evaporation, which often is much more than the amount actually used. If the drainage itself is dammed to form the holding basin, this drainage should be no larger than needed to supply the necessary water, for storms in these locations, when they do come, are violent. Erosion of the channels is heavy on account of the lack of vegetation, the topography of the country and the character of the soil, and causes the basins to fill with mud quite rapidly. It is necessary in some of these places to have a storage capacity great enough to last five years, with due allowance for evaporation, in order to carry through the dry periods.

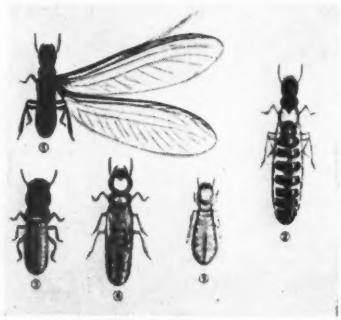
The water usually settles out clear in these reservoirs, but not always; whether the water needs treatment from a chemical standpoint depends altogether upon the character of the ground surface over which it flows before reaching the reservoir. In some places, where water can be taken from a large drainage area where at least one or two runs of water of sufficient duration can be depended upon each year, a very satisfactory plan is to provide the storage in a small side drainage and conduct the water into it through a ditch. In this way, water of the best available quality can be selected and shut off when the storage is filled.

One fact that I have not been able to account for is the small increase in dissolved solids in such reservoirs because of the concentration that must result from evaporation over a period of years. The Burlington has one such reservoir in a natural depression in Wyoming that has a surface area of 700 acres. A considerable part of it is 30 ft. deep. The water is conducted into it through a ditch from a flood stream and the amount taken from this reservoir for railroad use does not exceed 10,000,000 gal. a year, which would lower the lake about a half inch. There is very little seepage and the evaporation is about 40 in. a year. The water that is drawn from the reservoir is taken about nine feet below the high-water mark and we try to regulate the admission of water so that there is no surplus flow over the wasteway. I have had samples taken through the ice every five feet from the top to the bottom and the analysis showed very little difference in these samples, while over a period of nearly 20 years there has been very little change in the quality of the water.

*From a paper presented before the Illinois Section of the American Water Works Association at Chicago.

And Now the T

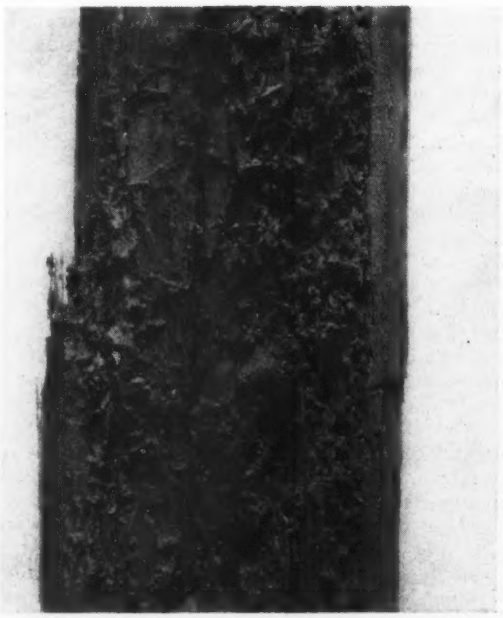
Native forest insect is transferring its attention to railway and other structures and is causing widespread damage



Dry-Wood Termites
(1) Winged adult; (2) queen; (3) soldier; (4) nymph; and (5) young

A NEW problem has been imposed on the users of wood in structures which has become so far-reaching as to call for determined action on the part of the railways and other wood-using industries. For several years there have been increasing reports of serious injury to various types of structures by termites, or, as they are more commonly but erroneously called, white ants. These reports indicate that no type of wooden structure is immune from attack and that the damage done may even be the equivalent of complete destruction. Whether this is the result of increased activity on the part of these insects, or whether it is due to increasing knowledge of their work, is not yet definitely known. It is known definitely, however, that in certain sections of the country the damage which they cause is on the increase, and it is the opinion of those who are studying the subject that this is true for the country as a whole.

Termite destruction has been noted or may be expected in any railway structure built of wood, either wholly or in part. Buildings in which wood occurs in the forms of window and door frames, flooring, siding or shelving, as well as piling and other bridge members, crossing plank, wooden culverts and drain boxes, are fertile ground for termites. Curiously enough, however, crossties and bridge ties seem to be singularly free from termite attack when installed in the track.



Side View of a Pine Post Destroyed by Termites

Of late, the subject of termite activity has reached a stage of such importance that the matter was made the subject of study and of report at the recent convention of the American Railway Engineering Association by a subcommittee of the Committee on Wood Preservation, of which Dr. Hermann von Schrenk, consulting timber engineer, St. Louis, Mo., was chairman. Also, in California, termite damage has become so widespread and aggravated that a special committee, known as the Termite Investigations committee, composed of entomologists, biologists, engineers and other representatives of the railways and other wood-using industries on the Pacific coast, has been formed to make a complete study of termites and termite damage and devise means of combating these insects. The following information regarding their habits, the damage they do and how infestation can be prevented, has been abstracted from Dr. von Schrenk's report.

Distribution of Termites

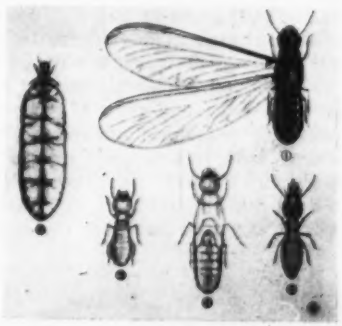
Termites are native insects in the United States, but they are also found all over the world in the tropic and temperate zones. So far, 42 species are known in the United States, although the actual number may be somewhat greater. They destroy dead wood of all kinds and gradually, together with wood-destroying fungi and other insects, remove such materials, breaking them down into simpler substances which eventually become a part of the soil.

Broadly speaking, there are two types of termites in the United States, the subterranean or soil-nesting type and the dry-wood or non-subterranean type. The distribution of these two types is shown on the accompanying map, line A-A being the extreme northern limit of the regions in which the subterranean forms are found, while line B-B indicates the extreme northern limit of damage so far known to have been caused by dry-wood termites. It will be noted that they are distributed throughout the country, although in the southern, southwestern and Pacific coast regions, where both types are found, they are more numerous and injurious than elsewhere.

What Termites Are

These so-called white ants are not true ants, although superficially they are antlike and live in colonies made up of different forms or castes. On the contrary they belong to the roach family. In the colonies or nests, both wingless and winged mature individuals are produced. The winged or sexual type, ranging from jet black to brown in color, elongate, slender and antlike in

Termite Problem



Soil-Nesting Termites
(1) Winged adult; (2) queen; (3) soldier; (4) nymph; and (5) worker

appearance, becomes the reproductive adult which, during a short period once a year, swarms forth from the parent nest in a great colonizing flight. The males and females pair, find a chink in a log, in the weatherboarding of a building or some other favorable spot for a nest, break off their wings and after a time, ranging from a few weeks to several months, the female or queen lays a few eggs. The types and stages of growth of the forms of the two types are shown in the two upper views.

The nests of some species of termites are in the earth

Map Showing Distribution of Termites in the United States

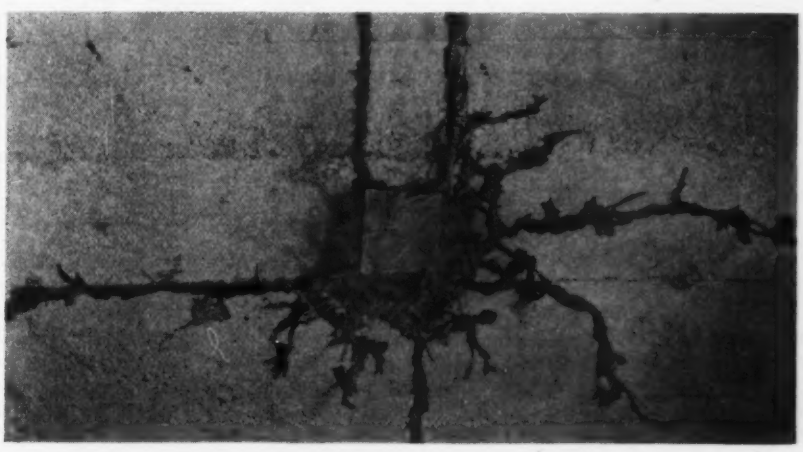
and in dead and decaying wood. These species, known as soil-nesting termites, are subterranean in habit, living almost entirely in the ground, timber and trees being attacked only through the earth. The nests of other species, known as drywood termites, are excavated in wood and trees by the winged forms, there being no specific worker type and no underground life.

Originally, and to a very large extent still, termites lived in the forests. Here the subterranean type builds its nests in the wood of standing timber, logs, stumps in cleared land, and in any wood in contact with the ground; or, in the plains, in a labyrinth of underground passages in the earth, usually underneath wood or vegetation. This type has soft bodies and the individuals conceal themselves within wood, in the earth or within the earthlike carton shelter tubes (lower right view), which they erect for the purpose of passing over impenetrable substances, such as foundation walls.

In burrowing through wood, the workers often completely honeycomb it, usually following the grain and eating out the softer, thin-walled, larger-celled spring or new wood. They are able to penetrate the hardest woods, provided they have access to moisture in the ground. In extending their galleries in wood and vegetation, the subterranean species carry moisture with them by means of moist excrement mixed with earth.

The dry-wood termites attack the wood differently. Instead of following the grain continuously they excavate through it, longitudinally, chambers of limited length. These termites are destructive to the woodwork and furniture in buildings as well as to living trees. They are able to live and thrive in wood containing less than the 12 per cent moisture normally contained in air-dried wood, a moisture content too low to give fungi or decay-producing organisms a foothold. They enter the wood directly, or in trees, through wounds, borer holes or under loose bark; with this type moisture is not necessary.

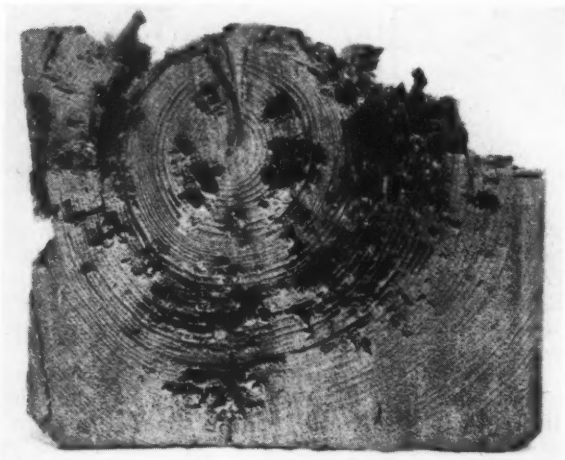
The subterranean type of termite is rarely seen because they shun the light and remain underground or,



Shelter tubes or exploration tunnels built by subterranean termites. In this case they obtained access through the nailing block set in the concrete

if they do come above ground, they protect themselves with enclosed tubes or galleries made of partly digested organic material. The workers are continually traveling about in the ground and whenever they come into contact with organic material they at once attack it.

It is easy to understand, therefore, how they gain entrance to telephone and telegraph poles, fence posts, crossing plank, box culverts, or any other wood in direct contact with the soil. They bore holes beyond the ground into the members and work upwards, being very careful, however, never to puncture the outermost layer of the



Cross-Section of a Pine Post Destroyed by Termites

wood. In buildings the point of entrance varies. The common point, however, is through the foundation wall, where the stones or bricks have been laid in poor cementing materials, through which the termite, in traveling upward, finds a ready entrance through the cracks or spaces which usually exist in such walls.

Recent studies made by Japanese investigators indicate that these insects are capable of dissolving lime mortar. It is of interest that experiments are now in progress at the University of Illinois with various kinds of mortar to determine the degrees of termite resistance.

Will Pass Through Minute Cracks

Once in the foundation wall they move upward and, if the top surface is not protected, they find easy access to wooden joists, and from these to flooring, siding and other wooden members. Cases are not infrequent where they come up through foundation walls and find their way between slabs of reinforced concrete which abut on either edge against an outer building wall or against interior walls. The shrinkage in the concrete slab is sufficient to provide a minute crack which allows an easy entry into the building to these small creatures.

Another point of entry is around basement window openings. They will build tunnels from the ground across the coping stone or, more frequently, at the ends of the coping stone, until they reach the wooden window frame and traveling up through the window frame, they will get into the wall above and thence into other parts of the building. Still another method by which they gain entrance into buildings is around pipes which either have contact with the foundation wall or directly with the ground. They build tunnels from the ground up along the pipes and enter the building through the small opening between the pipe and floor. Again, entry is often through posts set in basements as supports for either coal bins, shelving or partitions. It is a frequent but unfortunate practice to put the posts in position and then lay the cement slab for the basement floor.

In buildings of stone, brick or reinforced concrete, it is frequent practice for the builders to insert wooden plugs to serve as nailing blocks for base-boards, panels, etc. These nailing blocks are often allowed to remain in the finished building and termites find a ready entrance through the walls by means of these untreated blocks. In a recent case, a building of reinforced concrete which had been constructed so as to be supposedly termite proof, was found to be badly infested owing to the use of nailing blocks which furnished an entrance for these insects.

The obvious remedy, when it is necessary to resort to nailing blocks, is to creosote them heavily. If they are used on the outside of the wall, they should be removed when the forms are removed and the holes should be completely filled with a rich portland cement mortar.

In this connection, it should be clearly pointed out that attack by the subterranean type of termite is absolutely impossible, except through some contact with the ground. On the other hand, the dry-wood termites enter structures from the air. Any woodwork which is exposed above ground is, therefore, likely to be attacked by these species.

Termites chew the wood fiber and use it for food, although any one insect will digest only a small part

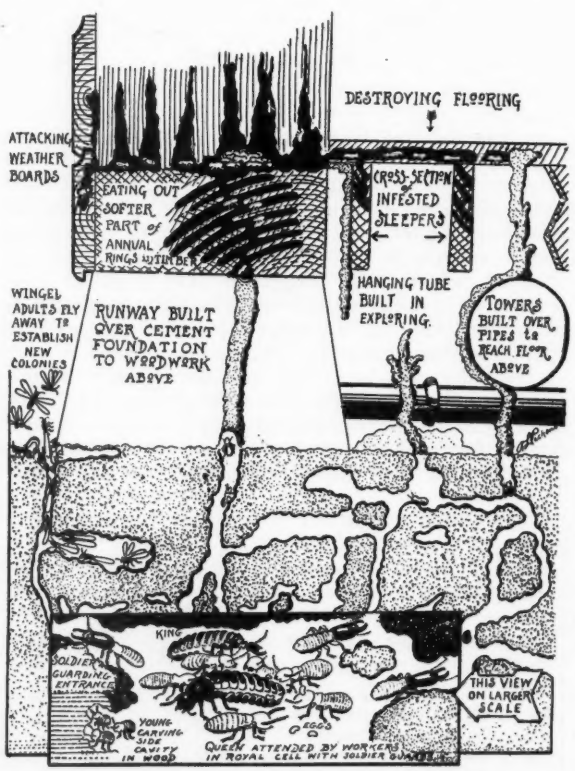


Diagram Showing How Subterranean Termites Enter and Destroy the Wood in Buildings

of what it eats. The wood may be completely destroyed, but more commonly it is eaten only in part. In pines and other conifers, the softer spring wood is usually eaten, leaving the harder summer wood intact. There appears to be no definite procedure, however. Hard oak floors are often eaten completely. The outer part of any member is usually left intact, so that a board

may ultimately consist only of a shell. All woods growing in the United States are subject to termite destruction, including both hardwoods and softwoods. There are a number of tropical woods which are universally immune, the most notable of which is teak.

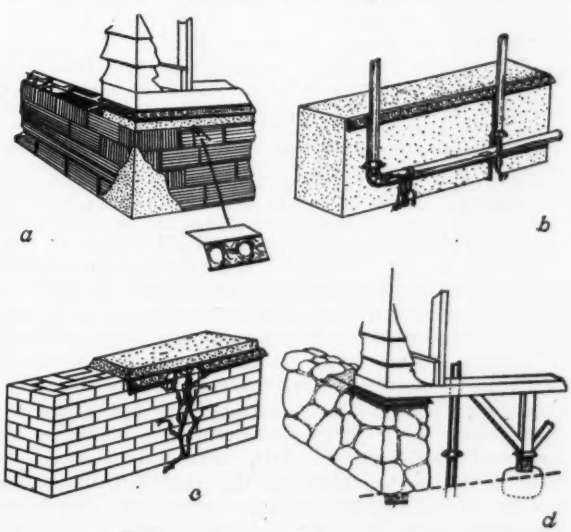
The presence of termites within a structure is rarely suspected. As already indicated, they may completely destroy a structural member without giving any external manifestation of their presence. They live a completely concealed life and disclose their presence in only four important ways: (1) By failure of the wood as a result of their attacks; (2) by emergence of the reproductive castes as swarming alates; (3) by the characteristic fecal pellets of the dry-wood termites, dropped from their workings; and (4) by the characteristic covered runways, "towers" or tubes which are built by the subterranean termites from earth to wood or from wood to earth. As a matter of fact, however, usually it is only by accident that their presence is discovered. A beam may fall or a floor give way when stepped upon.

One of the positive indications of their presence in a structure is the appearance, particularly in the spring, of the alate forms or so-called "flying ants." If these appear within a building, they are an absolute indication that these insects are working somewhere within the building. In such cases, careful note should be made of the point where these flying forms emerge, because they usually appear somewhere near the central or focal point of the worker's activity.

The presence of shelter tubes is always a certain indication of the presence of subterranean termites, as they occur wherever these insects emerge from the ground. Once seen, they will be readily recognized. Termites construct these tubes even where there is scarcely any light, and they are frequently found on the inner side of foundation walls in cellars or on the outside of the wall under porches, floors, etc. In some cases these insects will build tall, vertical, column-like tubes from the ground in their endeavor to reach food.

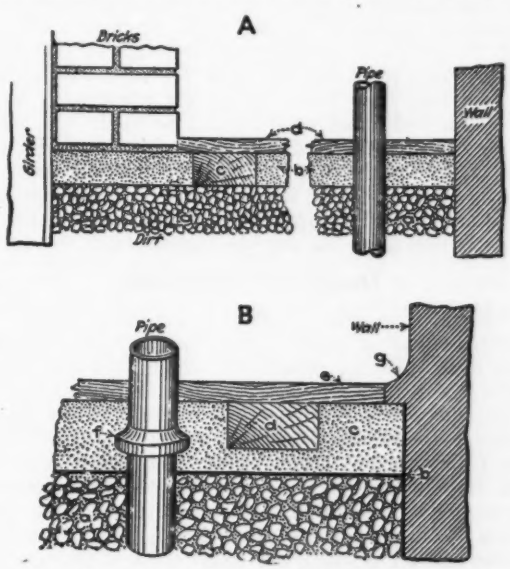
How Infestation Can Be Prevented

Because termites destroy structures it does not follow that it is necessary to eradicate them completely to find relief; in fact, such a procedure would be neither possible nor desirable. Most of the damage caused to buildings by subterranean termites results from improper methods of construction. Neither the age of the building nor the character of the construction materials determines whether it is open to attack. Wood, masonry, concrete, hollow tile and even rammed earth can be used effectively to prevent these attacks.



Methods of Insulating Foundations Against Termites

If it were realized how easy it is to prevent the infestation of structures by most species of termites, there would be very little destruction. This refers particularly to the more prevalent subterranean type. For posts, piling, crossing plank, wooden culverts, poles, cross arms and other materials of similar character, protecting methods are extremely simple, consisting in the preservative treatment of all timber that comes in contact with the ground. The most positive prevention is the use of creosoted timber, though some other preservatives have given excellent results and investigations are now under way to determine the relative value of various preservatives. So far as is known, thoroughly creosoted timber is never attacked by termites, except after many years of service, or where they have been



Properly and Improperly Constructed Basement Floors

able to reach the untreated portion of a treated timber. A light treatment may not be so effective, however.

Other preservatives have been advocated as being termite resistant, notably zinc chloride. While it is believed that this preservative is effective, if a heavy treatment is given, in protecting wood above ground, it is not so certain that the zinc-chloride treatment is effective for timber in immediate contact with the ground. A number of cases have come to attention during the past year in which timbers that had been given this treatment were badly attacked after a number of years, even though they still contained considerable quantities of zinc chloride.

For these reasons, it is believed that all timbers which are to be held in contact with the ground, including posts, piling, foundation timbers, timbers under platforms, foundation stringers, etc., should always be treated with at least 12 lb. of creosote to the cubic foot. This should be made a standard practice, even if no apparent termite infestation is known in the vicinity of the structure, because there is reason to believe that there is far more destruction caused by these insects than is commonly known or realized. Untreated lumber should always be piled on termite resistant foundations, which should reach sufficiently high above the ground so that the chances for approach by means of shelter tubes may be reduced to a minimum. These foundations

should be of stone, concrete or creosoted timbers.

The use of creosoted materials in buildings is not practicable, except for a few members. The protection against the subterranean type of termites is relatively simple, however. In the first place, the design of the building itself should be such that entrance cannot be effected. Complete insulation from the ground of all untreated woodwork is the only permanent preventive of termite attack.

It is the opinion of this committee that it is of the utmost importance that the foundation wall be so constructed that termites cannot enter it. After the wall is constructed, the surfaces should be coated with a layer of rich cement-sand mortar and troweled carefully so as to leave no openings. The top surface of the foundation should also be covered with a layer, at least one inch thick, of rich cement-sand mortar. In case there are any window or door frames, the exposed section of the foundation wall should be similarly coated before the frames are inserted. An additional protection which is now in wide use consists of a trough-shaped metal shield which is inverted over the top of the foundation wall. These have been found very effective in actual use. An additional protection is to apply a uniform coating of coal-tar pitch on the outside of the foundation wall from the bottom to the top, making sure that it is brushed evenly to insure that no openings or blow holes are left. This applies to interior cross walls and piers as well as to the outside foundation.

Design of Foundations

The next important factor to be considered is the matter of placing concrete slabs on footings or foundation walls, and the manner in which they are tied to vertical walls. During the past year several cases were examined where concrete slabs were laid on top of concrete foundation walls which were supposed to be free from attack by these insects. They gained entrance into the buildings, however, through the small openings between the foundation walls and the overlying slabs. When metal shields are used, the chance for entering in this manner is small, but where there is no such protection the top of the foundation wall should be coated heavily with coal-tar pitch before the slab is laid.

Furthermore, whenever a slab is laid against another slab, or against an existing vertical wall, a small space should be left on all the edges of the slab at points of contact. As soon as the slab has hardened this space should be filled with hot coal-tar pitch, so as to seal all openings completely. This precaution is particularly important whenever an addition is made to an existing building. Time and again cases have occurred where termites gained entrance through the small crack between the newly laid slab and the original wall. This is true not only for floors above the ground line, but applies with equal force to concrete floors laid in basements subsequent to the erection of the vertical walls. So far as has been determined, coal tar acts as an absolute barrier to termite attack. On the other hand, asphalts and other petroleum products are penetrated by the termites and are of no value.

All pipes and plumbing should be protected with collars wherever they pass through floor or walls. In the drawing of this detail, A shows an improperly constructed floor in which the wood sleeper is in contact with the loose material underlying the floor, the joints are not sealed and the pipe has no metal shield. In contrast with this, the floor shown in B gives complete protection, the sleeper being embedded in the concrete, the joints between the floor slab and wall sealed and a metal collar soldered around the pipe and embedded in the concrete slab.

Coming to that part of the building above the foundation, the important factor is to keep it as dry as possible. This not only protects against termites but against decay as well. In regions where termite attack is prevalent, the use of zinc-chloride treated lumber is suggested.

Remedial Measures Where Infestation Occurs

When a building has been attacked by termites, as indicated by swarming or the presence of earth-like shelter tubes, something should be done as soon as possible. Since every case presents problems of its own, it is not practicable to give detailed instructions as to procedure. Careful examination should be made, however, of the parts close to the ground. The outside of the foundation wall should be exposed to the bottom of the footing by means of a trench wide enough for men to work in. The wall should be carefully scraped and cleaned and pointed with cement mortar, after which two coats of coal-tar pitch should be applied. When the outside wall cannot be treated in this manner, the joists and stringers should be shoved up, if possible, and a coating of rich cement mortar applied to the top of the wall. When entry has been gained through the shrinkage of slabs, it is frequently necessary to remove the base-boards from the vertical walls and remove the lathe and plaster, or brick if the wall is of brick, in order to find the joint between the wall and slab. This joint should then be chipped out and filled with liquid coal-tar pitch. When window or door frames are attacked, the entire frame should be removed and the exposed section of the foundation wall pointed with rich mortar before they are replaced.

In any attempt to rid a building of termites, the point of entrance should be sought. The use of local applications of gas or insecticides are of no use. The killing of the swarming adults and possibly a small percentage of the workers by such applications only provides a liberal supply of food for the countless thousands that are not affected, which come out of the ground and carry off the dead as acceptable food. When necessary to replace wooden parts, this should always be done with treated timber.

Dry-Wood Termites

The discussion of preventive and remedial measures has dealt only with the subterranean termites. The dry-wood termite attacks buildings from the air. A very extensive study of these insects is now being made by the Termite Investigations Committee, which expects in another year to present some of the data it is now developing. At present, however, Prof. S. F. Light, a member of this committee, recommends the following:

> Look for nearby sources of infestation in dead portions of living trees, other buildings, fences, posts or poles. These should be eliminated if at all possible, or reduced to a minimum to prevent annual re-infestation. All infested timbers should be removed and burned. Where this is impossible or inadvisable, relief may be sought by the introduction of paris green by bellows or of orthodichlorobenzine. If the infestation is recent and the workings are so small as to make this difficult, watchful waiting would seem to be best.

Enough is now known of these insects to warrant paying very serious attention, particularly to all new construction, to make sure that every safeguard has been applied to prevent their entrance. Proper piling methods in lumber storage yards is also essential. Termite-proofing is a matter of a relatively small expense, rarely exceeding a few hundred dollars. There are three principal points to be given consideration. Insulation of untreated wood from the earth, metal termite shields to shut off the shelter tubes and the treatment of interior woodwork and furniture with preservatives. The latter recommendation, however, is essential only in the Gulf states, the Southwest and Southern California.

Getting a Spark

How to keep the ignition system in condition to insure efficient motor-car operation*†

By C. R. KNOWLES‡

AMONG the essential parts of an internal combustion engine is the equipment to provide for the firing of the fuel charge in the cylinder as it is only through the burning of the fuel that the power is released. This has been accomplished in various ways on different types of engines and has included a flame, hot tubes, balls and plates, high compression and electricity, the latter now being used exclusively on modern gasoline engines. The equipment through which the fuel is fired or ignited is termed the ignition system.

The systems used on a motor car differ in detail with different makes and types of cars, although they may be grouped between battery and magneto ignition, the functions of which are the same, although their construction and operation are entirely different.

Battery ignition, which is the more generally used, consists of the battery (usually four dry cells), a spark coil, switch, timer, one or more spark plugs and the necessary wiring. Multiple-cylinder engines require a spark plug and coil for each cylinder.

Modern high tension magneto systems, as applied to motor cars, dispense with batteries, timer and spark coil and in some cases with a switch; they are self-contained units, the transformer, interrupter and distributor being inherent parts of the magneto.

The Battery

The ordinary motor-car battery consists of four dry cells, connected together in series, zinc (outside binding post) to carbon (center binding post), as indicated in the typical wiring diagram for battery ignition. A battery of four dry cells will furnish ignition for from 2,000 to 3,000 miles of motor-car operation if properly cared for. While some motor-car operators have the mistaken idea that seven or eight dry cells are necessary to produce an effective spark, four dry cells are sufficient for any motor-car battery. The spark produced will be just as effective as one from eight cells, will yield more than double the life of an eight-cell battery when connected in series, and will not injure the spark coil. More than five cells will produce a voltage that will result in such a heavy current as to be injurious to the vibrator contacts,

A Dry Battery

When dry cells are connected in series, the combined voltage is equal to the voltage of a single cell, multiplied by the total number of cells used. The voltage of a new dry cell is about 1.5 volts, therefore, the voltage of five dry cells is approximately 7.5 volts. Instances have been noted where motor-car operators have connected as many as 10 dry cells together in series under the impression that more cells will extend the life of the battery and overcome the effect of exhausted cells. This is erroneous, as one depleted cell in a battery will produce the same effect as regards amperage as if all are exhausted, although the voltage of each cell will be about 1.2 volts when they are practically exhausted, or approximately 12 volts for the 10 cells, which is entirely too high for the ordinary spark coil.

When dry cells approach exhaustion, their life can be extended by connecting them together in parallel, that is, zinc to zinc and carbon to carbon. Connected in this manner, the amperage will multiply in proportion to the number of cells and the amperage of each. For example, five dry cells, each exhausted to 5 amperes, connected in parallel will produce current of 25 amperes. The voltage is, however, that of one cell or about 1.2 volts. By connecting a number of partially exhausted cells in series-parallel, which is a combination of both methods of wiring, the required voltage and amperage can be produced from partially exhausted cells. However, the time and trouble, together with the space required for the extra cells, is hardly worth while.

Cells Must Be Carefully Packed

Dry cells should be so placed in the battery box that the terminals will not come in contact with other cells or with the side of the box. They should be wedged firmly in the box with split blocks as provided by some manufacturers or with dry paper or waste, to prevent any movement through the vibration of the car. Any such movement of the cells in the box is detrimental as it may wear or cut the paper covering of the cells or permit the terminals to touch each other, causing short circuits.

Cells should be tested with a pocket ammeter before they are discarded in order to determine whether they are exhausted, for, as stated previously, one poor cell will produce the same effect as regards amperage as though all were exhausted. When testing dry cells with an ammeter or battery tester, touch the terminals firmly but remove the contact as quickly as the reading is obtained, as the battery is being short circuited when the ammeter is in contact and the cells are discharging at their maximum rate. Prolonged contact will run down the strength of a battery very quickly. New cells should test at least 30 amperes, while any cell testing less than 6 amperes should be replaced.

Extra cells should not be kept on hand any longer than necessary, for dry cells deteriorate almost as rapidly in storage as when in use. They should be stored in a cool, dry place away from radiators, stoves or steam pipes, as excessive heat will exhaust them more quickly than continuous use in actual service. On the

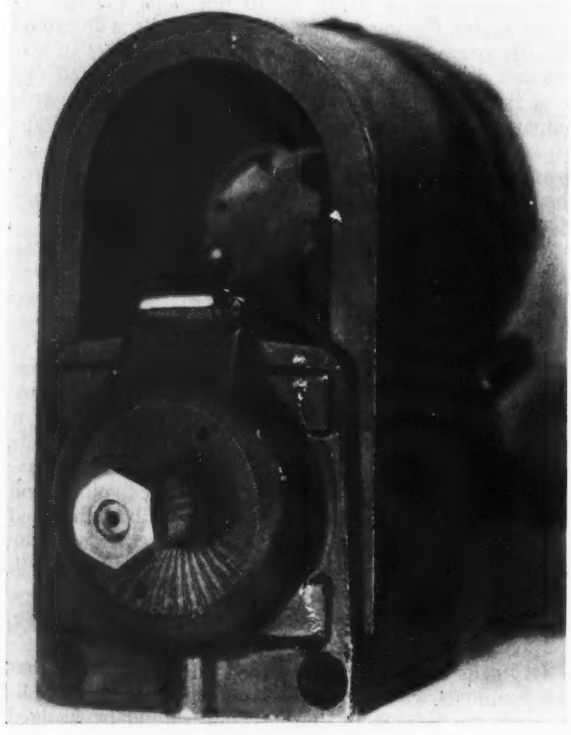
*This is the sixth of a series of 12 or more articles on the Care and Operation of Motor Cars, the first of which, on the Place of the Motor Car in Railway Work, appeared in the January issue, page 5, the second, on the Type of Motor Car, in the February issue, page 54, the third, on the Motor Car Engine, in the April issue, page 158, the fourth, on How a Motor Car is Built, in the May issue, page 214, and the fifth, on Proper Lubrication, in the June issue, page 248.

‡Mr. Knowles is in charge of the operation and maintenance of motor cars and other gasoline-operated work equipment on the Illinois Central System.

other hand, they should not be allowed to freeze. They should never be stored on their sides but should be maintained in a vertical position with the terminals end up.

The Magneto

The magneto, as designed for motor-car engine ignition, should not be confused with a generator for continuous current, as it is a device for producing a short, hot spark of electricity for ignition purposes only. The magnetos first used on motor cars were of the low-tension rotary type and were employed with what was known as the dual ignition system, consisting of the magneto, a set of batteries and a non-vibrating trans-



A High-Tension Magneto, Rotary Type as Used on Motor Cars

former coil. The current furnished by this type of magneto was primary or low tension and was raised to high tension or secondary by passing it through the transformer coil. The battery current was necessary for starting as the magneto was ineffective unless operated at a fairly high speed.

Another design of magneto that was used to some extent a few years ago was the oscillating type. It did not prove successful owing, in part, to the high engine speeds required and also to the fact that proper adjustment could not be maintained on account of the jerky operation.

A number of motor-car manufacturers are now equipping motor-car engines with high-tension magnetos of the rotary type. This type is self-contained, with the transformer, interrupter and distributor built in, and does not require any additional ignition equipment. This type of magneto has been developed to such a high state of efficiency that, under certain conditions, it is quite as satisfactory as a battery and coil. It is more desirable for high engine speeds.

The flywheel type of magneto, such as is installed on outboard motors for driving small boats, is also used to some extent on motor-car engines. This type of magneto is built into the flywheel and is a part of the engine and operates on the same general principle as other magnetos.

While magnetos differ somewhat in design and application, they are of the same general type and require the same care in operation, particularly with respect to oiling and cleanliness. Magnetos should be oiled carefully in accordance with the instructions of the manufacturer, and extreme care should be exercised to see that too much oil is not used as it is important to the operation of a magneto that it be kept clean and free from oil. The best way to care for a magneto is to leave it alone, as most magneto failures are due to their being tampered with. Any repairs or adjustments should be made by a skilled mechanic who is familiar with their construction and operation.

The Timer

The proper operation of a gasoline engine demands that the fuel mixture be ignited at the proper time. This is accomplished on motor-car engines by what is termed a timer. The timer is usually located directly on the crankshaft of a two-cycle engine, and is driven by gears from the crankshaft of a four-cycle engine. It makes a contact at each revolution of a single-cylinder, two-cycle engine and at each second revolution of a single-cylinder, four-cycle engine. The contact closes the primary circuit, causing the spark coil vibrators to "buzz" and a spark to occur between the firing points of the spark plug at the proper time, thus igniting the fuel charge. The spark may be advanced or retarded by changing the position of the timer which is controlled by a lever operated in conjunction with the throttle to control the speed and power of the engine.

When the engine is started or running at low speed, the spark should occur as the piston reaches the "top" of the stroke or head of the cylinder. An advanced spark is one that occurs before the piston reaches the "top" of the stroke. A retarded spark is one that occurs after the piston reaches the "top" of the stroke.

Fully retarding the spark causes the charge to be ignited either at the top dead center or immediately after it. The point of ignition is changed with the engine running so that spark occurs slightly ahead of dead center or before the piston reaches the top of the stroke. The amount of the advance varies with the speed of the engine and is designed to secure the greatest efficiency of operation.

The length of timer contact is important. If it is too short it will not produce a satisfactory spark while if it is too long it will waste the dry cells by keeping the battery in circuit longer than necessary.

A variation in the length of contact for different cylinders of multiple-cylinder engines may cause unbalanced operation of the engine. For example, with one timer contact too long and the other too short, one cylinder may require a richer fuel charge than the other in order to fire properly. If the spark is advanced far enough to secure proper ignition in the cylinder served by the short contact, it will in all probability cause pre-ignition in the cylinder served by the long contact. Reversing the order and retarding the spark in order to provide proper ignition in the cylinder served by the long contact, will retard the spark too much for the other cylinder served by the short contact and it will overheat. A lack of uniformity of timer contact will often explain why one cylinder overheats or has less power than the other.

No set rule can be established for length of contact that will apply to all timers, owing to the difference in

design and shape of the contacts which vary from a sphere to a flat surface. Where a flat surface contact is used, the length of contact is fixed permanently and can be affected only by dirt or wear. An oval surface, like a ball, is not only affected by dirt and wear but also requires care in adjusting the tension on the contact spring as this tension determines the length of contact. In the absence of definite knowledge, the proper contact can be determined by tests in actual service. The timer should be kept clean and well oiled. Particular attention should be given the spring and contact button to insure that they move freely.

The Spark Coil

A spark coil is merely a transformer for converting the primary current from the battery into high tension current. It consists of two coils of wire wound around a soft iron core, a condenser and a vibrator or buzzer. The vibrator leaf, on which is located the movable contact point, acts as a spring when the coil is in operation. It is adjusted by means of a screw, which determines the tension on the vibrator and controls the buzz, which in turn indicates the intensity of the spark.

A Spark Coil

To adjust a spark coil vibrator, one should tighten the adjusting screw until a loud buzz occurs, then, with the engine running, gradually reduce the tension to a point where the engine begins to miss explosions, then tighten the screw until the missing is stopped. This adjustment will produce a spark strong enough for good ignition and will not waste current.

Many motor car operators adjust the coils to produce the loudest possible "buzz," thereby deliberately wasting as much battery current as the coil will take. A tight adjustment of the vibrator also results in throwing away dry cells before they are exhausted. For example, a battery of dry cells reduced to 10 or 12 amperes will operate satisfactorily with a loose adjustment of the vibrator and give several hundred miles additional service, where they would be discarded with a tight vibrator adjustment. Improper adjustment of the vibrator not only wastes dry cells but the high current flow burns and pits the vibrator and timer contacts. Pitting of vibrator contact points is due largely to too much battery current. At least fifty per cent of the flattening and grooving of timer contacts is due to high current flow rather than wear.

The secondary wires are sometimes detached from the spark plug to test the coil or wiring. In following this practice, current should never be passed through the spark coil without a suitable gap, which should not exceed ¼ in., as the secondary current will ruin the coil by puncturing the insulation inside unless a suitable circuit is provided for the current, such as the gap formed by the spark plug firing points.

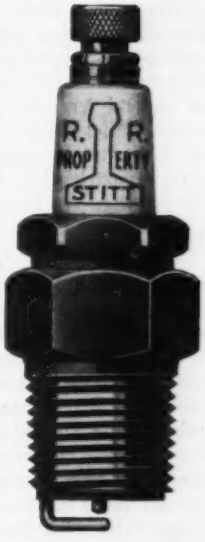
Spark coils should be protected from moisture and grease or oil. The contact points should be kept clean and smooth at all times. They should seat flatly against each other and should be perfectly matched, for where the full surfaces of the points are not in contact their life will be reduced. They should be cleaned when necessary with a fine file or emery cloth. To prevent burning and pitting, special care should be given the points during damp or rainy weather or when the engine has been in continuous operation for a long period.

Spark Plugs

A spark plug consists essentially of a shell which screws into the cylinder, the insulator (commonly termed the porcelain, as most insulators are made from special grades of porcelain designed to withstand high temperatures), the bushing which holds the insulator in place, and insulator gaskets which prevent loss of compression between the shell and the insulator. The center electrode or firing point passes through the center of the insulator and the side electrode which is attached to the inner part of the shell adjacent to the end of the center electrode, forming a gap through which the high tension current passes in the form of a spark.

The spark plugs commonly used in motor-car engines are ½-in. standard thread with a short projection, or what is sometimes termed a cold plug for use in hot, high-compression engines. The spark gap between electrodes should be between 0.03 in. and 0.04 in. for battery ignition, the higher figure probably being the most satisfactory for most motor-car engines. The compression in cylinders of motor-car engines ordinarily ranges from 35 lb. to 45 lb., with a maximum of 70 lb. in some engines. The lower compressions permit of a slightly wider spark gap and a longer spark, which is advantageous with fuel mixtures which may be a little too lean or too rich. A worn dime ranges in thickness from 0.038 in. to 0.040 in. and in the absence of a spark gage, may be used to measure the spark gap. Magneto manufacturers recommend a spark gap 0.020 in. wide for magneto-equipped engines, which is about equal to the thickness of a U. S. post card or a shipping tag.

An improper spark gap is the cause of many engine failures and a spark plug is often scrapped when it could be put in good order quickly by adjusting the spark gap. The spark gap is also of particular importance when using a poor grade of gasoline and in cold weather.



Type of Spark Plug Used on Motor Cars

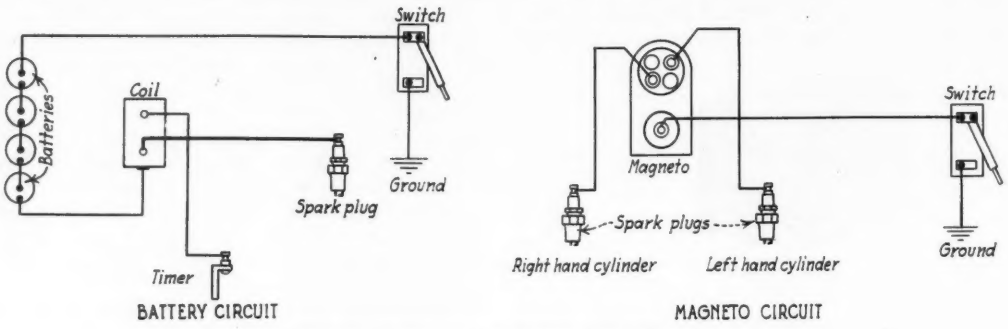
Spark plugs become foul from too rich a fuel mixture, from an excess of lubricating oil, or when for other reasons a coating of soot or carbon on the insulator or porcelain creates a short circuit or path to the shell instead of causing it to jump from point to point and form a spark. The fouling of spark plugs is usually indicated by the engine missing or by the failure of the engine to start when cranked. To clean the plug, remove it from the cylinder and clean it with a cloth or waste. Scrape hard deposits from the porcelain with a knife. Do not use sand paper or emery cloth on the porcelain as it may destroy the glaze, permitting it to absorb dirt and oil, and cause short circuiting.

If the plugs are taken apart for cleaning, care should be used in reassembling them by screwing the parts together tightly, so that the porcelain is firmly and tightly seated on the gasket; otherwise loss of compression through the shell of the plug will produce such intense heat that the porcelain may break and the electrodes and

ground wires will burn off rapidly. Pre-ignition may also occur because of compression leakage. Leakage of compression can sometimes be prevented and the life of plugs increased by simply replacing old gaskets with new ones. There is little danger of cracking the porcelains by screwing the plug parts tightly together, provided wrenches of the proper size are used and are not permitted to slip off and strike the porcelain.

Spark plugs are frequently destroyed through the breaking of the porcelain insulators. A frequent cause of this is the bending of the center electrode to set the spark gap. The shell electrode should always be moved in setting the gap. Other causes of porcelain breaking are: Too lean a mixture, producing excessive heat; valves of four-cycle engines sticking or not seating properly, or the use of the wrong kind of plug.

Extra spark plugs should be handled carefully to avoid damage to the porcelain or firing points. Care should be used in removing them from the cylinder to avoid breaking the porcelain or causing other damage to the plug. They should not be screwed too tightly into the cylinder, particularly if it is hot, for they will then be very hard to remove and the expansion of the plug may damage the porcelain. Use a socket wrench, or an end wrench of the right size in handling spark plugs. Pliers, pipe wrenches or large monkey wrenches are a frequent cause of damage to plugs. With proper care, a spark plug should be good for 10,000 miles in the average roadway motor car.



Wiring Diagrams for Motor-Car Ignition

Wiring

The wiring system on a motor car is for the purpose of transmitting the electric current from the battery or magneto to the spark coil, timer and spark plugs.

The accompanying diagrams show typical methods of wiring the various electrical units comprising the ignition system on a motor car. All wires should be insulated and should be of the proper size and kind for the purpose required. When it is necessary to splice the wires or where the insulation may be worn off, they should be wound with tape. Intermittent missing is often caused by the shorting of the current where the insulation has been worn away, or by broken wires concealed by the insulation. The insulation is easily destroyed by oil and grease and should be kept clean to prevent damage and short circuits. The wire connections to batteries, magneto, spark coil, switches, timer and spark plug have good contacts. Nuts on all binding posts except those on the spark coil should be tightened with pliers. The spark coil binding posts are connected to small wires inside the coil box and are easily broken if the binding posts are turned.

The following rules have been drafted as representing good practice in maintaining ignition:

(11) Keep the ignition system in good condition. If the engine refuses to start, try the spark first, then the gasoline. A combination of spark and proper fuel mixture is sure to produce an explosion.

(12) Do not use more than five dry cells in a battery, as more are wasteful and will injure the spark coil.

(13) Pack the dry cells firmly in the battery box, wire them in series, zinc (side binding post) to carbon (center post), and tighten the nuts on the binding posts with pliers.

(14) Test used cells with an ammeter before discarding them. Do not discard cells testing 8 amperes or more as they will give additional service by adjusting vibrator contacts properly.

(15) Store dry cells in a vertical position in a cool, dry place. Do not expose them to extreme heat or cold. Avoid keeping them on hand for any length of time as they deteriorate rapidly in storage.

(16) Oil magnetos carefully and keep them free from dirt and oil. Do not tamper with them or attempt to make adjustments or repairs without a full knowledge of their construction and operation.

(17) Keep timer contacts properly adjusted to secure the best spark with the minimum battery. Maintain a uniform length of contact on all cylinders of multiple-cylinder engines.

(18) Keep the timer clean and well oiled, particularly the contact button and spring, which should move freely.

(19) Adjust the vibrators on a spark coil to secure the best spark. Do not see how loud you can make it buzz, but keep the adjustment as loose as possible and thereby prolong the life of the battery and the contact points.

(20) Do not buzz the coil with a secondary wire detached from the spark coil unless provision is made for a suitable gap to avoid damage to the coil.

(21) Maintain a proper spark gap between the spark plug electrodes, 1/16 in. for battery ignition and 1/32 in. for magnetos. Do not try to adjust the gap by moving the center electrode, as it will break the porcelain.

(22) Keep the spark plug clean and free from soot and carbon. Do not use sand paper or emery cloth on porcelain. Do not screw spark plugs in too tight or use pliers, a pipe wrench or a large wrench on them.

Wrapping a Pipe Line with a Corrosion Inhibiting Material

Maintenance of Way Men Can Do Much to Correct Their Own Unsafe Practices

How to Reduce Accidents

If men quit taking chances, deaths and injuries can be cut in half and 200 lives saved in a year

According to L. E. KELLER
Statistician, Brotherhood of Maintenance of Way Employees, Detroit, Mich.

IN THE United States we kill annually through accidents about twice as many people in times of peace as the United States lost in active service during the late World War. Our annual deaths from accidents now run about 100,000; which means that approximately 6 per cent of all deaths result from accidents. If more of us took care and fewer of us took chances this annual slaughter would be materially reduced. The causes of death which are more important than accidents are only six in number and are diseases of long standing seriousness. The seven principal causes of death, in the order of their importance, are: Heart disease, pneumonia, nephritis, cancer, tuberculosis, cerebral hemorrhages and accidents. All could be reduced if taken hold of in time but none to a greater extent than accidents.

On our railroads we have made commendable improvements but much remains to be done. In 1928, according to Interstate Commerce Commission accident figures, there were 1,268 railroad employees killed and 67,289 injured on Class I roads. This is less than one-half the number killed in 1918 but twice as many as it should be. If we quit taking chances and start taking care, we can easily cut this number in half and avoid the suffering, lost time, deaths, widows, orphans and frightful aftermath. With three deaths a day in the ranks of railway employees and a reportable injury each 7½ min. of the night and day, we should awaken to a full realization of the fact that the business of safety is everybody's business. You or I may be tomorrow's victim.

The foregoing figures do not represent all of the deaths and injuries. They include only the deaths that occur within 24 hours, for under the reporting rules of the Interstate Commerce Commission if death ensues after a lapse of 24 hours from the time of accident the casualty is reportable as an injury. Likewise, the 67,289 injuries above referred to are only those occurring to employees sufficient to incapacitate them from performing their ordinary duties for more than 3 days in the aggregate during the 10 days immediately following the accident.

One Every Seven and One-Half Minutes

Having been born in a section house, having worked in the maintenance of way department about 15 years and now serving my eleventh year as a representative of the Brotherhood of Maintenance of Way Employees, I am particularly concerned with the maintenance of way group. How do we measure up? What part are we playing? To what extent are we affected by these deaths and injuries? In 1928, maintenance of way employees represented 23.8 per cent of all railway employees and suffered 31 per cent of all the deaths as well as 27 per cent of all the injuries. Of the 1,268 accidental deaths of all railway employees, 394 or roughly 1 out of every 3, were in the maintenance of way group. Our craft suffered 19,051 reportable injuries, an average of better than 62 for each of the 306 workdays of the year. This means that for every hour of an eight-hour workday 8 of our craft are injured badly enough to be laid up for more than 3 days—one every 7½ min.

How do these maintenance of way accidents occur? To reduce them and to be better prepared to guard against them, we should know the chief causes. It is not sufficient to dismiss the subject with the old stereotyped statement that men are careless and that they are wholly to blame. There is a growing resentment on the part of employees to this charge. Some are careless, of course, but what about the careful man who is injured through no fault of his own? Frankly speaking, the

splendid work of railway management in its efforts to reduce deaths and accidents is being impaired to some extent by the too-frequent charge of carelessness filed against railway employees. The thing of importance is to find the cause and remove it.

The first big cause of maintenance of way deaths is that resulting from being "struck or run over by trains." There were 192 deaths from this cause in 1928 and of this number 118 were section men. There were also 144 injuries from this cause. We see, therefore, that more than one-half of the maintenance of way men who met accidents from this cause lost their lives. The use of motor cars is one outstanding cause of deaths and injuries that is growing in recent years at an alarming rate. In 1928, casualties attributable to maintenance of way motor cars resulted in 53 deaths and 2,450 injuries. Deaths and injuries from this cause are not declining at the same rate at which the total number of deaths and injuries from railroad accidents from all causes are declining. Foremen should never relax in their safety requirements with respect to motor-car operation, even if given a line-up on trains. But, these accidents could be reduced if the policy were adopted of getting a line-up before using the main track. Placing tools safely on motor cars is also important.

While the motor car has unquestionably proved a great time saver it has also proved itself to be a poor device with which to make haste. We have never yet seen a management that objected to a lot of work but at the same time we have never seen a management that approved of the policy of taking chances just to get a little more work finished. Don't do it! One of the best section foremen I ever knew is washing cars in a garage today because he violated motor-car rules. He stayed out too long, loaded his tools on a push car, put the push car ahead of his motor car, then started hell-bent for the tool house. A derailment resulted, with three men crippled. Don't let it happen to you.

Falls Caused 4,363 Casualties

Falls of employees on the railroad, including all classes, non-train accidents, cost 44 lives and 4,319 injuries in 1928. An interesting comparison may be made between the deaths caused by war and those due to falls in times of peace. The war deaths in the 150 odd years' existence of the United States have numbered 111,012. The deaths due to falls average about 14,000 per year in the United States and eight years would pile up a total equalling the war deaths of 150 years. The "fall of man" is a serious problem today even though Adam and Eve have been gone for a long time. Incidentally more people are injured through falls in bathtubs than on football fields. Watch your step, especially when lifting heavy loads.

Handling rails, ties, bridge timbers, etc., caused 10 deaths and 7,841 injuries in 1928. Men should not undertake to lift heavy material until all taking part in the work have properly assumed their places and are prepared to move together. They should know that their footing is safe. Men should not work too close to each other in handling heavy tools and "green" men should not be allowed to use such tools as adzes or spike mauls when others are near them.

Defective tools should not be used, and when a tool of a given make fails to hold up well this fact should be brought promptly and emphatically to the attention of officers. Nobody on the railroad knows as much about track and bridge tools as the men who use them every day.

A profitable means of reducing accidents of this kind would be to hold safety meetings following our regular local lodge meetings, and division and safety officers should be invited to attend. It is a peculiar fact that men feel more free to talk at a meeting of their own than they do at one called by the management. Whether this should be or not, it is true and, furthermore, when men promote safety meetings themselves they begin to feel a more direct personal responsibility. The point is driven home with a more lasting effect. To listen to lectures about what ought to be done is one thing; to take the bull by the horns yourself is another. If the brotherhood were given the safety work on a system to promote, with proper co-operative supervision and assistance of the management, more, in my opinion, could be accomplished. This is but one of the ways in which the management and organized employees can co-operate to the mutual interest of management, men, stockholders and the public. The Brotherhood of Maintenance of Way Employees, at its last two triennial conventions, pledged itself to the principle of co-operation and is now developing an extensive co-operation plan on the Canadian National. It should be made general after a workable plan has grown out of the first experiments.

Strains and sprains from lifting and slipping are next in importance. Then come the injuries from flying objects. Flying particles of steel have injured many eyes. It is not enough for the man holding the chisel to wear goggles but others in the gang should stand off at a safe distance. A piece of steel that will injure the eyes of the man holding the chisel at a distance of 2 ft. will usually do the same thing at 10 ft., but we are apt to overlook this fact. In tripping jacks, watch your feet and those of others in the gang.

Of the 148 classes of railroad employees covered by Interstate Commerce Commission reports only 10 showed casualty rates per million man-hours higher than bridge and building carpenters and only 26 were higher than section men. Maintenance of way regular apprentices showed the highest rate for any of the entire 148 classifications. Their rate of 224.49 was nearly 3 times as great as the class with the second highest rate, 88.84. The 1928 rate of deaths and injuries per million man-hours in the maintenance of way group is higher than for any other except the train and engine-service group. Figures are tiresome but here they are (in the table).

What do the 19,051 maintenance of way injuries mean in lost time? In 1928 the average daily wage of all maintenance of way employees was $4.11; figuring 3 days' lost time for each of these injuries the wage loss was $234,898. Adding to this the injuries that caused less than 3 full days' lost time and those that caused more than that, we can reasonably assume that maintenance of way employees lost in excess of a half million dollars in wages because of injuries in 1928. With this 1928 wage loss, 714 homes could be built at a cost of $7,000 per home.

What Death Records Show

The death benefit records of the Brotherhood of Maintenance of Way Employees show that close to 16 per cent of all our claims cover members accidentally killed in railroad service. I recently studied 6,000 of these claims and found that 928 covered deaths from these accidents. Earlier in this article I pointed out that deaths from accidents stood seventh in the principal causes for the United States as a whole. In the death benefit records of our Brotherhood accidents rank third, only being exceeded by diseases of the heart and by diseases of the lungs, including pneumonia, influenza, tuberculosis, etc. If we separate pneumonia

from the other lung diseases, deaths from railroad accidents rank second.

Owing to the isolation of maintenance of way gangs, the fact that they are placed largely on their own responsibility, the fact that they rank second only to train and engine-service men in deaths and injuries, the fact that their decline in deaths and injuries is not keeping pace with those of other groups of railroad employees and owing to other features bearing on safety, it might prove a good thing if a maintenance of way safety car were equipped and kept in service as an educational medium. By arranging to have several gangs assemble at a given point and at a specified time, impressive demonstrations could be made with appropriate lectures. The significance thus placed on safety work, together with the vivid demonstrations thereby made possible, would make a lasting impression. After all, when a man is constantly faced with "Safety First" signs and slogans year in and year out they eventually lose much of their effect. To see a man drowned has more effect than reading about 10,000 being drowned; by virtue of this same psychology actual displays of the cause and effect of accidents will be far more effective.

Casualty Rates Per Million Man-Hours, 1928

Group of Employees	Eastern Dist.	Southern Dist.	Western Dist.	Total, United States
I. Executives, officials and staff assistants; and—				
II. Professional, clerical general				
Killed	0.04	0.01	0.05	0.04
Injured	2.31	1.10	1.81	1.91
III. Maintenance of way and structures:				
Killed	0.54	0.29	0.32	0.40
Injured	19.35	14.34	21.11	19.17
IV. Maintenance of equipment and stores:				
Killed	0.17	0.13	0.12	0.14
Injured	16.46	9.03	15.74	14.73
V. Transportation (other than train, engine and yard):				
Killed	0.18	0.11	0.16	0.16
Injured	17.63	9.64	11.78	14.18
VI. (a) Transportation (yardmasters, switch tenders and hostlers):				
Killed	0.32	0.29	0.30	0.31
Injured	12.41	8.45	16.58	12.89
(b) Transportation (train and engine):				
Killed	0.66	0.68	0.63	0.65
Injured	28.56	26.35	26.74	27.53
Total employees on duty:				
Killed	0.32	0.24	0.26	0.28
Injured	17.09	12.09	16.45	15.93

Lack of Training a Factor

It would be of value to know the length of service of those killed or injured as well as the day of the week and the hour of the day in which accidents occur. Inexperience with the work and with railroading in general is conceded to be a feature of importance in connection with accidents. This places an increased responsibility on the foreman when gangs are increased through the employment of "green" men in the spring and summer. It also increases the hazards to the regular men in the gang. This creates another strong argument in favor of more stable forces throughout the year and happily for all concerned many railroads are beginning to see the desirability of more uniform forces in the maintenance of way department.

In a number of industries, fatigue has been found to be a contributing cause to accidents, but in the absence of data showing the day of the week and the hours of service preceding accidents no definite figures are available with respect to maintenance of way employees. Since fatigue is known to contribute to accidents in some industries where scientific investigations have been made, it is at least possible that the same is true in maintenance of way work and it is therefore practicing safety first to be doubly careful in the last hours of the day's work. In other words, be careful at all times and especially so when tired, since no man's brain and muscles work as quickly or in as complete co-ordination when fatigue sets in.

In safety work co-operation is of greater value than too severe discipline. It is not inferred here that maliciously or habitually careless men should be smiled upon benignly. They should be removed from the service. At the same time a spirit of resentment grows out of the practice of dragging men "on the carpet" for small safety infractions. Usually a man who has lost time and endured physical suffering as the result of an accident has been punished enough. Nobody likes to be bawled out. More co-operation and less discipline should produce more effort and fewer injuries.

Should He Be "Turned In"?

Another doubtful feature of the safety work on some railroads is the policy of insisting that employees report each other for unsafe practices. Regardless of the value that may be derived from this practice, it is not in the best interests of the vitally important safety work on any railroad because railway employees do not look kindly upon this practice or upon their fellow workmen who engage in it. There is no use in trying to whitewash the reporter with the claim that he is acting in the best interests of all concerned.

When he adopts the practice of reporting others he is an object of contempt in the eyes of the average railway employee. Here again the local lodge meetings of employees' organizations are of value. The organized maintenance of way employee is not in sympathy with carelessness and will not hesitate to thrash these points out at his meetings where he will call a spade a spade. He will demand a correction of careless and unsafe practices but he will not submit cheerfully to the policy of reporting his fellow employees. This policy will never be administered successfully.

Finally, an important thing to keep in mind always is that no safety rules have ever been written, perhaps never will be written, that will cover all conditions at all times. Good old-fashioned horse sense will always be needed and we have it in our department because those without it can't last long in maintenance of way work. The work in this department is such that constant official supervision is impossible and men who can't think straight soon pass out. The foreman who was once called a kingsnipe is now recognized as the king pin in maintenance of way safety work but all have their individual responsibility.

We are killing and maiming more men in our department than there is any justification for. Unnecessary wage losses are resulting, uncalled for suffering and sorrow are being experienced, widows and orphans are being made in unnecessarily large numbers. Let maintenance of way employees correct their own unsafe practices and bring to the attention of the management the unsafe points that need managerial attention. and the close of 1930 will find some of our craft enjoying good health who might otherwise be selling shoe strings or pushing up daisies. Let's live and let live a little longer.

Better Materials
Produce Marked Savings

*But the field for further economies is a large one**

By EARL STIMSON
Chief Engineer Maintenance, Baltimore & Ohio

THE maintenance of the property of the railroads of the United States, including tracks, structures and equipment, which for the last seven years has cost an average of over two billion dollars a year, has become largely an engineering problem. The annual expenditures for maintenance are three times as large as those for enlarging and improving the property.

The Interstate Commerce Commission's figures for 1928 show that $846,000,000 was spent in that year for the maintenance of way and structures. This is $33,000,000 less than the 1927 expenditures, and only $5,000,000 more than the average expenditures for the preceding five years. This indicates that in spite of the increasing demands that are being made upon the track and structures by the increasing wheel loads and traffic density, maintenance of way expenditures are holding about level.

The large expenditure for maintenance is divided about equally between labor and material. The two outstanding items of material are rails and ties. There were 3,804,749 tons of rail used in replacements in 1928, at a total expense of $138,685,712, while 77,390,941 crossties and 269,062,440 ft.b.m. of switch and bridge ties were used in that same year, carrying a total charge of $118,074,069. The two items of rail and ties cost $256,759,781, or 30 per cent of the total maintenance expenditures. Frogs, switches, crossings, rail joints, bolts, spikes, tie plates, etc., cost approximately $60,000,000. Ballast added another $23,000,000, bringing the total expenditures for track materials to around $340,000,000, or 40 per cent of the total.

As large an expenditure as this certainly offers a wide field for the practice of economies. The proper design and the careful selection of the right grade of material to suit particular service conditions are fundamental. Care in application and upkeep is another essential to get the full service life out of the materials. This not only results in economies in material but also saves labor by requiring less frequent renewals. The co-ordination of the schedule of the receipt of materials with the program of work, whereby the materials may be unloaded direct at the site of the work, will minimize expense and avoid the waste of storing and rehandling.

It has been a long step from the earlier day of the 56-lb. rail to our present rail of 130-lb. section. From 88 tons a mile, which would now cost $3,748, we have found it necessary to use 204 tons a mile at a cost of $8,784, an increase of $5,000 per mile for this material alone. Increased wheel loads and tonnage forced the increase in rail weight, and there is every probability that the movement towards heavier loads will continue.

One of the functions of a rail is to transmit the loads to the ties. It must have a head of such shape and hardness as to withstand the wear of wheels, and it must have girder strength sufficient to distribute the load to the ties without undue stress. On these bases the Rail committee of the A. R. E. A. instituted a study last year of the economic value of different sizes of rail, which, though not complete, gives interesting information from the standpoint of both theoretical development and practical analysis of railroad data over a series of years. Study thus far indicates a bettered track condition and resulting economies in maintenance from the use of increased weights of rail.

From the study, it was shown theoretically that an increase in the weight of rail from 70 lb. to 136 lb. gave a 47½ per cent stiffer track, while stress in the

*Abstract of a paper presented before the Metropolitan Track Supervisors' Club, New York.

rail was decreased 58 per cent and pressure on the subgrade 62 per cent. By analysis of actual expenses for track labor it was also shown that, for similar traffic density, there was a lower cost of maintenance per million gross ton miles on 130-lb. rail than on 85-lb. and 90-lb. rail.

The Results Are Apparent

It is probable that those who have observed the transition to heavier rails in tracks in their charge have noticed the relief in man-hours of labor required for upkeep. Its reflection may have been in reduced forces needed for maintenance, or in an improved condition of track. It may not always have been in evidence immediately upon making the substitution, because there are extraordinary expenses involved in connection with the renewals incident to such changes, which prevent immediate reductions or the reassignment of forces to other localities. Over a period of years, however, as the road becomes seasoned, these benefits do accrue and are felt.

Unfortunately, the use of the maximum weight of 130-lb. rail on Baltimore & Ohio lines to the present time has not extended over any one division for a period of more than four years, and, therefore, comparisons of expenses before and after the period of transition are not comparably accurate, owing to the extraordinary expenses of the latter period which include the work of making the out-of-face renewals of ties customarily following rail renewals.

Even so, we found on a subdivision with 178 miles of main tracks, that in a three-year period, beginning the second year after the 130-lb. rail was laid, there was a reduction of 15.5 per cent in man-hours in main-track line and surface work, compared with a three-year period representative of conditions with the 100-lb. rail existing prior to the beginning of the use of the 130-lb. rail. Though this is partly attributable to the use of additional labor-saving equipment, and to a possible increase in the efficiency of labor, it is evident that it is due largely to the use of the heavier track material.

Further Possible Savings in Crossties

No material in railroad expenses, except fuel, requires so heavy an outlay as does the crosstie. In 1928 the Class I roads, operating 403,516 miles of tracks, laid 77,390,941 ties in replacements, in addition to 7,210,117 ties for construction. Total charges to the operating expense tie account were $118,074,069.

In no item of railroad expense has greater economy been secured than in this one. Many years ago, about 1904 or 1905, the roads began to take steps to reduce the drain on their resources, as well as on the timber supply of the country, resulting from the extraordinary crosstie requirements. The hope lay in the use of preserved wood, and it is to their credit that the development of the wood-preservation industry as it exists in this land today, is the result of the activity of the railroads in applying it to their needs. It was apparent that returns would not be immediate. In fact, it was recognized that expenses for ties for a number of years would be sharply increased. Fortunately, the initiation of the practice and its rapid extension were not delayed.

As a result, during 1928 a total of 70,114,405 crossties were treated; almost enough to meet the total annual replacement figure stated previously. As nearly as I am able to derive the figures, it can be said that between 65 per cent and 70 per cent of the crossties now in tracks are treated.

Let us see what this means in material conservation. In the 403,516 miles of tracks operated by the Class I railways there are about 980,000,000 ties. Sixty-five per cent, or 637,000,000, of these ties are treated and cost in track approximately $950,000,000. They can reasonably be expected to give an average service of 20 years. If the use of untreated ties had continued, this same 65 per cent would have been in track untreated, and would have cost approximately $725,000,000. An average life of not to exceed eight years could have been anticipated from them.

On this basis we secure the following annual costs, which include interest on the investment, plus a sum which, placed in a sinking fund, will, at the expiration of the life of the ties, equal their original cost:

If untreated ties had been used	$117,750,000
Treated ties used	82,825,000
Saving per year due to treatment	$ 34,925,000

This is a tangible sum in which all of the roads have shared. In many cases the savings on individual roads have been much greater than the average, and suggest further possibilities through the adoption of more advanced and permanent methods of preservation, and through greater care of the ties.

One case which has attracted much attention is that of a leading eastern carrier whose tie renewals each year for the past 10 years have averaged less than 100 per mile, and in the last 2 years, slightly over 50 per mile. Judging by past standards, it seemed incredible that such a low rate of renewals could long be maintained. Through the courtesy of the chief maintenance officer of that road, I was permitted recently to analyze the data pertaining to crosstie use, covering each year's renewals for the last 20 years. Not only was it found that the low rate of renewals in recent years was justified, but also that for the next few years, a renewal even less than the present minimum of 50 ties per mile may reasonably be expected. This condition arises from the rate at which treated ties were used in replacing untreated ties, giving at this time a situation where the former have not yet reached their maturity, and where the latter, the untreated ties, have almost disappeared.

The value of thorough treatment of ties with standard oil-borne preservatives, as well as the protection of the ties against mechanical wear by the use of heavy rail, adequate tie plates, and well-drained ballast and roadbed, are proven by the experience of this road, as essential to the attainment of the maximum service from treated ties and the greatest economy from their use.

Joints Offer Field for Improvement

As a corollary to the use of heavier rail and better ties, heavier and improved track fastenings have been employed. Rail joints of many designs have been developed and used, and many of them have been found wanting. Probably no one feature of track maintenance has provided such a difficult problem as this one of finding a joint construction which will give the rail at the joint a service condition equal to that afforded throughout the remaining length of the rail.

The several leading types of joints in use have had wide distribution on the railroads of America and have seen many years of service under a variety of conditions. Many special designs of more limited distribution, but probably of equal service, are also in use. Each has its advocates, and claims of advantages possessed by the different types are variously pressed and countered.

The merits of these claims will not be discussed, for though it may be granted that improvement has been made, it can be stated with assurance that the ultimate rail joint has not yet been developed. The field still remains wide open.

Immediately allied with the joints are the bolts and

nuts upon which reliance is placed to give the tension required to afford 100 per cent service from the joints. Two types of threads, the U. S. standard rolled thread and the Harvey Grip thread are commonly accepted. Square and hexagonal nuts are in service and each has its advocates. Special designs of nuts embodying locking features are widely promoted and many claims of their superiority are presented.

Supplementing these are the spring washers and many types of nutlocks designed in an attempt to meet the requirement that adequate tension must be constantly maintained in the bolts. Here again it must be said that the ultimate solution remains to be worked out. Whether or not it is reasonable to anticipate a device which will automatically maintain the required tension is another problem which we will leave with the specialists in design and manufacture. This we do know, however; that under the present situation, close attention to track bolts is needed to give satisfactory joint conditions.

Loose Bolts Proportional to Traffic Density

Recent observations of test sections of track on our lines containing many different combinations of bolts and nuts have shown that the number of loose bolts of any one type is approximately directly proportional to the tonnage passing over them. In one location where 36,000,000 gross tons per year had been carried, the percentage of loose bolts with the same kind of nut fastening was five times as great as in another location which carried only 8,000,000 tons per year. There were, of course, differences between the various types in the same location, but as the record of this comparison is not yet complete, conclusions have not been drawn. Suffice it to say, however, that the total number of loose bolts found in these tests would constitute a surprise to even some of the most experienced trackmen.

As an instance: In the location over which a total of 36,000,000 gross tons per year were carried, 2,580 bolts of a certain type had lately completed two years of service. They were inspected each three-month period, at which times all loose bolts were tightened. A total of 2,625 loose bolts were found here during the two years. This means that the equivalent of every bolt was loose sometime during the two-year period. Other tests under different tonnages showed loose bolts in numbers almost proportional to the tonnage carried. This indicates the need for attention to loose bolts and, incidentally, it gives food for thought upon the proposition that the period between the tightening of bolts is not seasonal, nor uniform for all sections of the road, but rather, should be governed by the density of traffic on each section of the line.

Approximately 40 per cent of all track labor is required to keep the track in line and surface. Most of the defects in surface, and in line as well, have their origin at the joints. It is apparent, therefore, that a rail joint which holds up the rail ends will save a large amount of labor in surfacing. Economy in rail joints is measured by effectiveness and not by price.

Economy and reduction in costs is the order of the day. These can be accomplished only by getting all there is out of present practices by initiating improved practices and by employing better materials offered by others. The fact that you, yourself, do not happen to originate the new, is no reflection on you and no reason why you should shut your eyes to its advantages. We sometimes spend a vast amount of mental energy thinking of numerous reasons why some new device or some change in method is no good, and why it should not be used, when it is only necessary to think of one good reason why it should be used or put in service.

More Light Cast on Transverse Fissures

JAMES E. HOWARD, engineer-physicist of the Interstate Commerce Commission, discussed the occurrence of transverse fissures and their relation to the weight of the rail, the ingot letter and the heat number in a report on a passenger train derailment on the Pennsylvania near Onley, Va., last December, in which 9 persons were killed and 32 injured as a result of a broken rail containing two transverse fissures. Mr. Howard's remarks pertinent to the problem of transverse fissures are abstracted in part as follows:

It is an open secret that practically all railway engineers ascribe the fundamental cause in the display of transverse fissures to defective steel for which, in their judgment, the manufacturers are responsible. There are controllable conditions at the steel mills which influence the physical properties of the finished rails. The chemical composition and mechanical treatment most suitable in the fabrication of the rails should be established definitely. The production of steel rails is one part of the problem; the proper use of the rails constitutes another part of the same problem, not inferior to the first.

Between Onley, Va., and Farnhurst, Del., 153 miles, 34 rails of 100-lb. section had been removed from the track because of transverse fissures during the 14 months ending with December, 1929. During the same period of 14 months, a total of 257 rails were removed from track on the Eastern region of the Pennsylvania because they displayed transverse fissures. Of these, 164 were 130-lb. rails, 12 were 125-lb. rails, 78 were of the 100-lb. section and 3 were 85-lb. rails. The ages in service ranged from 3 mo. to 40 yr. Twenty-six were less than a year old; nine were more than 20 years old. Of the 130-lb. rails, 24 less than a year old were selected and the ingot letters recorded as follows

Ingot letter	A	B	C	D	E	F	G
Number of rails	4	4	4	6	1	3	2

Their distribution in different parts of the ingot does not show a predisposition to display fissures in rails from any particular part of it. The rail of shortest life, 3 months old, bore the ingot letter C. Out of a group of 31 rails over 6 years old each, the following results appeared:

Ingot letter	A	B	C	D	E	F	G
Number of rails	4	6	6	9	0	2	4

In a larger group of 212 rails the ingot letters were

Ingot letter	A	B	C	D	E	F	G
Number of rails	64	31	38	42	16	10	11

The heat numbers of 210 of the 257 rails were found. Out of this number, 192 heats were represented by only one rail each; 10 heats were represented by 2 rails each; 5 heats had 3 fissured rails each; 1 heat had 4; 1 had 5; and 1 was represented by 7 fissured rails. This is an answer to the queries which commonly attend discussions of the rail problem, although as questions of metallurgical interest they have little to commend themselves. The relations between rail failures and stresses in track afford matters of greater interest. From the segregation of transverse fissures in different localities, it would seem that the places where the heats chanced to be located and not the heats themselves, materially influenced their numbers. Five rails of one heat number were located within the range of the same mile post.

In one instance during this period, 31 fissures occurred in 130-lb. rails in the eastbound freight track in a distance of 19 miles. The average life of these rails was 2 yr. 8 mo. Sixteen of the defective rails were found within the limits of two mile posts and 10 heats were represented at one of these.

EUROPEAN STATIONS—The American traveler arriving in Prague, capital of Czecho-Slovakia, is generally surprised to discover that the name of the main station is President Wilsonavo Nadrazi, in honor of the wartime president of the United States. For really bizarre effects, the station at Ulm in southern Germany takes the prize. This large and commodious station is painted a bright green, with lilac borders around the doors and windows. In deference to the fact that Austria is now a republic, they have painted the word "Emperor" from the name of the main station at Vienna, and it is officially "The Franz Josef Bahnhof."

Reducing the Hazard at Highway Grade Crossings

Committee report presented at third National Conference on Street and Highway Safety embodies comprehensive program

ACCIDENTS at railway grade crossings caused 2,485 fatalities and 6,804 non-fatal injuries in 1929, or 8 per cent of the estimated total of the 31,000 motor vehicle fatalities which occurred in the United States in that year, according to a report of the Committee on Protection of Railway Grade Crossings and Highway Intersections which was adopted by the third National Conference on Street and Highway Safety, held in Washington, D. C., on May 28, 29 and 30. The report also pointed out that railway grade-crossing accidents during the four years, 1926 to 1929 inclusive, have averaged 5,783 a year. Of this number, 4,399 were motor vehicles struck by trains; 1,272 were cases in which automobiles ran into the sides of locomotives and trains; while 110 involved occupants of other vehicles, or pedestrians. Despite the large number of grade-crossing eliminations, costing more than $60,000,000 a year during 1926, 1927 and 1928, statistics presented by the committee show that the total number of grade crossings is increasing annually as a result of new highway construction.

The committee recommended a comprehensive program of measures for reducing the number of crossing accidents which will require the co-operation of the railways, public authorities and the users of the highways, from which the following is abstracted:

Reduction of Physical Hazards

The reduction of physical hazards at grade crossings requires, according to the committee, that, in addition to warnings and other protective measures, there should be:

(a) Practically level and smooth highway surface between the tracks or within the highway intersection and for at least 25 and preferably 50 ft. on each side of the tracks or intersection; approach grades not exceeding 4 to 5 per cent; widening of the roadway at the crossing or intersection; avoidance of sharp highway turns and junctions within 250 ft. of the crossing or intersection and of important highway intersections within at least 500 ft. of the crossing, if ultimate grade separation may be contemplated.

(b) Avoidance of standing of railroad cars, parked highway vehicles or other temporary obstacles, and removal of banks, trees, shrubs, standing crops, buildings, billboards or other permanent obstructions to give sufficient view of the tracks or cross road to enable traffic to pass safely under normal conditions of operation, or, if this be impracticable, then, under conditions of more cautious operation, proper indication by warning signs or other protective measures.

(c) Where artificial lighting of highways or grade crossings is economically practicable, special care should be taken to insure that the lights are so located as to illuminate the fixed signs without glare interfering with visibility from the point of view of the highway user. Consideration should also be given to visibility of rolling stock as affected by the color of paint used thereon and as illuminated by automobile headlights or street or highway lights at the grade crossing. Visibility from the side should also be provided for in the lighting systems on motor vehicles.

Standard Fixed Signs and Markings

In the opinion of the committee, warning should be given of the proximity and character of a railway grade crossing at sufficient distance from the crossing to enable the driver of a vehicle to regulate its movement so as to be able to stop, if necessary, and otherwise determine before reaching the crossing whether he can cross in safety. To accomplish this, the committee recommended the following standard signs which are in complete agreement with those specified in the manuals prepared by the American Association of State Highway Officials for rural highways, the American Engineering Council for city streets and the American Railway Association for signs and signals on railway right of way at grade crossings:

(a) *Advance Warning Signs and Pavement Markings.*—At each highway approach to a railway grade crossing there should be erected not less than 200 ft. (in cities not less than 100 ft.) nor more than 450 ft. from the crossing a standard circular highway advance warning sign, illuminated or with reflecting letters, consisting of a black "RR" and cross on a yellow background.

As a supplementary advance warning of approach to railway grade crossings on hard surfaced, heavily traveled highways where rail traffic is fast or frequent, pavement markings should be employed, using the standard form approved by the American Association of State Highway Officials. On wide highways lane markings are also recommended. On three lane highways, the two righthand lanes approaching the crossing should be marked; on highways of four or more lanes, all lanes to the right of the center line.

(b) *Speed Limit or Stop Signs and Supplementary Slow Signs.*—In addition, at a point nearer the crossing, there should be erected a speed limit sign or a stop sign depending on the following conditions:

(i) Outside of business or residence areas, where the view of the track is not obstructed within necessary visibility zones, and no special hazard exists, a standard rectangular 30-mile speed limit sign in black letters and numbers on a white background should be erected 50 ft. from the crossing.
(ii) Where the view of the track is obstructed within necessary visibility zones, or where other special hazards exist, a standard 15-mile speed limit sign, illuminated or with numerals of reflecting type, should be erected 50 ft. from the crossing.

(iii) Where due to extreme limitation of view or other specially hazardous conditions crossings have been designated by the proper state commission, in accordance with the Uniform Vehicle Code, to require all vehicles to stop, there should be erected not less than 15 or more than 50 ft. from the crossing, at such highway approach, a standard octagon stop sign, illuminated or with letters of reflecting type, bearing the word "Stop" with black letters on a yellow background (red letters on yellow background within municipalities and optional elsewhere).

(iv) Where the speed limit or stop sign cannot be seen sufficiently in advance, a standard diamond-shaped slow sign with black letters on a yellow background should be erected not less than 100 ft. in advance of the sign specified in paragraph (b) above.

(c) *Crossing Signs.*—At all grade crossings a standard railroad crossbuck sign with two arms mounted across each other should be installed on the railroad right of way. In case of multiple tracks there should be mounted below the crossbuck arms a clearly legible sign indicating the number of tracks.

Approach Warning and Protection Measures

At many grade crossings the amount or character of the railway and highway traffic warrants special warning of the approach of trains in addition to the warning by locomotive whistle or bell. For such crossings the committee recommended the following, in addition to the standard fixed signs and markings:

(a) *Automatic Train Approach Signals.*—At crossings on heavy traveled highways where there are sufficient intervals between train movements, either of the following standard visible warning signals should be installed

(i) A wigwag signal with a swinging target and red light.

(ii) A flashing light signal with two red lights in a horizontal line 30 in. apart flashing alternately.

As adjuncts to other train approach warning measures, but not as substitutes therefor, bells or other audible signals may be used.

Careful study by the railroads should be continued to determine the feasibility of using time control for train approach warning signals at crossings; that is, such control as will give warning always at the same number of seconds before the train actually arrives at the crossing, regardless of the speed of the train.

(b) *Crossing Gates and Watchmen.*—At crossings on heavily traveled highways where frequent switching movements or shortness of intervals between train movements requires more prompt and positive indication of approach of trains and of clearance of the crossings for highway traffic, crossing watchmen or manually controlled crossing gates or signals should be provided. Crossing watchmen should be equipped with standard crossing watchmen's stop signs, red flags and lanterns. Gates should be made conspicuous by alternate black and white 12-in. striping at an agle of 45 deg. sloping downward toward the center of the highway.

Obedience to directions given by gates, crossing watchmen or positive crossing signals is required by the Uniform Vehicle Code.

Accident Record

The number of grade crossing accidents and fatalities has remained nearly constant during the past four years, despite an increase of 20.4 per cent in motor vehicle registrations during the same period. The recent trend in grade-crossing accidents has been more favorable than that for general traffic accidents, yet the fact that 2,500 persons are killed annually at grade crossings emphasizes the continuing importance and magnitude of the question of crossing protection.

The committee was unable to appraise the effectiveness of the various types of protection, because it lacked data as to the amount of highway traffic passing the crossings at which the various types of protection are in service. The following table was given, however, to show the number of crossings for each type of protection and the number of accidents at such crossings for a typical year.

Grade Crossing Accidents in 1928 According to Types of Protection

(Interstate Commerce Commission Statistics)

	Number of Crossings	Accidents	Fatalities	Nonfatal Injuries
Crossing gates	5,707	179	88	106
Crossing watchmen	7,297	643	207	762
Visible and audible signals	8,004	331	192	354
Visible signals	3,635	440	245	431
Audible signals	4,572	318	165	354
Fixed signs	205,933			
No signs	4,941	3,841	1,671	4,659

Grade Separation

The next table shows the number of new crossings added and the number of existing crossings eliminated during the three-year period, 1926-1927 inclusive, these being for all steam railways.

Grade Crossing Elimination

(Interstate Commerce Commission Statistics)

	1926	1927	1928
Number of new crossings added	1,876	1,909	2,068
Number of existing crossings eliminated	1,254	1,391	1,204
Number eliminated by separation of grades (included in the last figure above)	195	245	270
Net increase during year	622	518	864

While there was a net increase of 2,004 crossings during this three-year period, the crossings that are being eliminated are mainly those where the greatest exposure occurs. The same is true of crossings at which protective devices are installed. Hence the aggregate hazard at unprotected crossings is being reduced more than the figures as to crossings eliminated and protected might indicate.

Extent of Protection

The following table shows the number of protected and unprotected crossings for the Class I railways only:

Protective Measures at Grade Crossings

	1926	1927	1928
Protected by gates, watchmen, or automatic signals	27,927	28,724	29,215
Protected by fixed signs or barriers	202,620	203,817	205,933
Unprotected	4,611	3,742	4,941

A part of the increase in number of crossings from 1926 to 1928 is due to the amalgamation of Class II and III railroads with roads in the Class I railway group.

Such analyses as have been made of the effectiveness of the different types of crossing protection, taking into consideration the volume of traffic on the railway and highway indicated to the committee that protection is of unquestionable value in reducing accidents.

The committee found that there has been a steady decline, year by year, in the number of crossings protected by gates and also in the number protected by watchmen. It called attention to the fact, however, that this does not indicate retrogression in either methods or extent of protection. On the contrary, it points out, the crossings selected for elimination are usually those at which one or both of these types of protection are being utilized, while a part of this decline is attributable to the substitution of flashing-light or wig-wag signals for gates or watchmen. In its view the trend of protection is toward the visible type of automatic signals which indicate the approach of trains.

In this connection the committee made the following observations on the cost of installing, operating and maintaining crossing protection and division of this expense:

The inhtallation cost of a flashing-light or wigwag train-approach signal varies greatly according to number of tracks, type of installation and particular location. Recent studies show a spread in usual costs from $1,500 to $4,000 per crossing, while some installations cost less than the minimum here indicated and others more than the maximum. Annual maintenance, depreciation and operating costs average at least 20 per cent of the cost of installation. A recent study of the cost of manually-controlled gates indicated an average of $1,278 per crossing for installation, with an annual cost (for maintenance, operation, watchman's wages and so forth) in excess of $3,000 per year. With 240,000 grade crossings to be protected, it is obvious that the costs of automatic wigwag or flashing signals or of gates and watchmen would be such a large amount,

The Railway Industry at a Glance

Operating revenues and expenses of the Class I steam railways in the United States, from data compiled by the Bureau of Statistics, Interstate Commerce Commission

	Month of April			Four Months Ending With April		
	1930	1929	Decrease 1930 under 1929 per cent	1930	1929	Decrease 1930 under 1929 per cent
Total Operating Revenues	$451,203,158	$514,700,445	12.3	$1,783,304,189	$1,996,319,769	10.7
Expenditure for maintenance of way and structures	**68,183,633**	**74,045,394**	**7.9**	**237,968,166**	**254,329,935**	**6.3**
Total operating expenses	348,214,351	377,045,331	7.6	1,386,713,499	1,475,466,990	6.0
Net railway operating income	62,271,581	94,168,377	33.9	238,507,531	353,439,684	32.5

which, in the last analysis, must be borne by the public, that these special forms of protection can be installed only at the crossings where there is considerable rail and highway traffic.

In order to avoid placing an undue burden upon the railroads, and to assist in expediting the provision of appropriate protection of this character where needed, the public authorities should contribute a fair share of the costs of such protection, following principles similar to those adopted in sharing the expense of grade-crossing elimination.

$1,329,535,000 Spent For Materials in 1929

THE CLASS I railways spent $1,329,535,000 for materials and supplies during 1929 for operating, maintaining and improving their properties, according to a report made by the Bureau of Railway Economics. These figures cover direct purchases only and do not include the large purchases which were made indirectly through contractors doing work for the railways and through manufacturers of railway equipment, payment for which was included in the payments for the completed construction or equipment.

The direct purchases for 1929 exceeded those for the previous year by $58,194,000, or 4.6 per cent, and, while somewhat smaller than the five year average from 1923 to 1927 inclusive, they reflect quite definitely both the magnitude and stability of the railway market from year to year.

Direct purchases of forest products by the railways in 1929 amounted to $157,551,000, but were $3,243,000 less than in 1928. Crossties accounted for $83,421,000 of this total, although the number of ties purchased, 79,366,000, showed a decrease of 10.6 per cent in quantity and of $12,263,000 in cost, when compared with the 88,774,000 ties which were bought in 1928. Switch and bridge ties in 1929 accounted for 289,215,000 ft.b.m. of timber, at a cost of $10,642,000, an increase of $1,266,000 in cost and of 30,753,000 ft.b.m. of material, or 11.9 per cent. The purchases of lumber and structural timbers amounted to 1,419,804,000 ft.b.m., an increase of 4.9 per cent, at a cost of $55,002,000 or $5,404,000 more than was spent in 1928. The purchases of other forest products, which includes piles, poles, posts, etc., amounted to $8,486,000, which is $2,350,000 greater than in 1928.

Increase in Iron and Steel Products

An outlay of $437,840,000 was made by the railways in 1929 for iron and steel products, which represents a consumption of 17 per cent of the total production in the United States for this year. Compared with 1928, this was an increase of $40,296,000, or 10.1 per cent. The purchases of steel rails accounted for $94,195,000 of this total, and represented an increase of $2,014,000, or 2.18 per cent over the purchases made in 1928. Rails comprise 7.08 per cent of the total purchases made by the railroads, greater than any single item, except fuel, which amounted to 27.41 per cent of the total purchases. Crossties, representing 6.27 per cent of the total purchases, stand next below rail in this respect. If the purchases of bridge and switch ties are combined with those of crossties, however, this item becomes 7.07 per cent or substantially equal to rail in cost and in ratio to total purchases.

As might be expected in view of the larger tonnage of rail purchased, frogs, switches, crossings, track fastenings, bolts, spikes, tie plates and rail anchors showed an increase, the purchases in 1929 amounting to $70,971,000 as compared to $67,376,000 in 1928, an increase of 5.34 per cent.

The purchases of structural steel for bridges, turntables and buildings, including bar iron and steel and steel forgings, increased from $45,001,000 in 1928 to $57,330,000 in 1929, or by $12,329,000. The direct purchases of cement also showed a large increase, 21.1 per cent, as compared with the previous year. The purchases in 1929 amounted to 4,069,000 bbl., at a cost of $7,628,000. These figures exceed those of any year since 1922 and are almost double the purchases made in 1923, 1924 and 1925. The total production of cement in the United States for 1929 amounted to 172,408,000 bbl., so that the direct purchases by the railways represented 2.4 per cent of the total production. In addition to this, however, a great quantity of cement was furnished by contractors for construction and replacement work which was done under contract.

Inventories

At the close of 1929 the Class I railways of the United States had approximately $472,000,000 tied up in unapplied materials and supplies, according to an analysis made by the *Railway Age* of the operations of 117 carriers operating 163,000 miles of road, or 96 per cent of the Class I mileage of the country. These inventories comprise the book value of the materials and supplies purchased directly by the railways and carried in stock for use. They do not include, however, any materials purchased and held for application by contractors doing work for the railways or special purchases of materials which have been bought and segregated for large construction projects which are being carried on independently of railway operations.

The total inventory of the Class I roads comprises $40,000,000 for fuel, $95,000,000 for ties, $45,000,000 for rail and $292,000,000 for stores and miscellaneous materials. Based on the average consumption for the 12 months of 1929, for the railways as a whole, the year ended with a 324-day supply of ties, and a 111-day supply of rail.

Purchases of Fuel, Material and Supplies by Class I Railways of the United States—1923 to 1929

Item	1929	1928	1927	1926	1925	1924	1923
Fuel	$ 364,392,000	$ 384,608,000	$ 437,821,000	$ 473,354,000	$ 459,465,000	$ 471,656,000	$ 617,800,000
Forest Products	157,551,000	160,794,000	175,729,000	186,291,000	170,305,000	180,872,000	232,511,000
Iron and Steel Products	437,840,000	397,544,000	432,604,000	507,302,000	419,255,000	365,610,000	464,955,000
Miscellaneous	369,752,000	328,395,000	348,774,000	392,085,000	343,018,000	324,917,000	423,437,000
Grand Total	$1,329,535,000	$1,271,341,000	$1,395,928,000	$1,559,032,000	$1,392,043,000	$1,343,055,000	$1,738,703,000

Note: All prices include freight and handling charges.

Quantities of Materials Purchased by Class I Railways of the United States—1923 to 1929

Item	Unit	1929	1928	1927	1926	1925	1924	1923
Bituminous coal	Net tons	120,730,000	122,380,000	130,190,000	140,084,000	129,325,000	126,372,000	154,902,000
Anthracite coal	Net tons	3,174,000	3,654,000	3,199,000	3,678,000	3,780,000	4,673,000	5,016,000
Fuel oil	Gallons	3,004,120,000	2,762,736,000	2,765,259,000	3,058,916,000	3,043,783,000	2,848,550,000	2,962,619,000
Cross ties	Number	79,336,000	88,274,000	97,135,000	93,760,000	87,965,000	98,130,000	113,907,000
Switch and bridge ties	Bd. measure—Ft.	289,215,000	258,462,000	326,735,000	365,957,000	306,444,000	329,040,000	2,388,785,000
Timber and lumber	Bd. measure—Ft.	1,419,804,000	1,353,808,000	1,285,289,000	1,580,767,000	1,416,111,000	1,296,430,000	
Steel rail	Gross tons	2,138,000	2,080,000	2,278,000	2,504,000	2,179,000	1,779,000	1,889,000
Cement	Barrels	4,069,000	3,060,000	2,673,000	3,127,000	2,104,000	2,211,000	2,416,000
Ballast	Cubic-yards	30,426,000	27,156,000	28,430,000	25,422,000	21,673,000	14,265,000	*

*Not reported.

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer?

Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE SEPTEMBER ISSUE

1. *How long an interval should elapse after treatment before creosoted ties are inserted in the track? Why?*

2. *Under what conditions is it advisable to clean rather than replace incrusted pipe lines? What methods of cleaning can be employed?*

3. *Where lateral drains are laid under the track in wet cuts, how far apart should they be placed? Should they all drain to the same side of the cut or should the alternate laterals drain to opposite sides? Why?*

4. *Where an excess stock of heavy relayer rail accumulates in the course of main-line renewal operations, what disposition should be made of it? To what extent is a road warranted in laying it on branch lines having traffic too light to furnish, in itself, economic justification for rail of this weight?*

5. *What practical methods can a track foreman employ to keep his tools in good condition?*

6. *How can efflorescence on brickwork be prevented or minimized? When it occurs, what means can be employed to remove it?*

7. *Is it practicable to renew a cap on a ballast-deck trestle without removing any of the deck? If so, how?*

8. *What is the most satisfactory design of a wood floor for an overhead highway bridge carrying heavy automobile traffic?*

Second-Hand Spikes

What limitations should govern the use of second-hand spikes? Should they be used when laying new rail?

It Is Often Economical to Use Them

By J. MORGAN

Supervisor, Central of Georgia, Leeds, Ala.

There seems to be no reason why second-hand spikes should not be used wherever they are in condition for reuse. I would consider a foreman remiss in his duty if he discarded a usable second-hand spike, and used a new one instead. Even if throat cut, they can often be used to advantage when double spiking rail that is supported on tie plates, using two new spikes and placing one second-hand one inside the rail. If the spike is straight and is not throat cut, I know of no reason why it should not be as serviceable as a new spike. If it is bent, it is a simple matter to straighten it by laying it on the rail and striking it sharply with the spike maul. If the head is broken off it is not serviceable, of course, nor should it be used if the throat cutting has progressed to the point where the spike is likely to break under driving.

Avoid Use in Main Tracks or New Ties

By GENERAL ROADMASTER

A great many second-hand spikes are recovered in usable condition, and where they are fit for further service there is no good reason why they should not be reused in ordinary maintenance. The question of what constitutes the dividing line between usable material and scrap may be open to debate, however, and the practice in this respect frequently depends upon the standards of maintenance under which the track forces are working.

In my own opinion, a spike that is only slightly worn at the throat can be used on sidings and other secondary tracks, but should not be applied in main tracks or on curves, where the spikes should all be in first class condition. Throat-cut spikes should never be used around switches or crossings, or in new treated or untreated ties; neither should spikes that have been bent and straightened be used at these places. In the first instance the stresses that are set up by the passage of trains through turnouts demand that only the best material available shall be used. In the latter case, the life of a new spike is likely to be less than that of the ties, so that the use of partly worn spikes increases the damage the tie must undergo through respiking and thus shortens its life.

If the throat cutting has progressed to a greater degree, the spike should be discarded for every purpose. The difference between its scrap value and the cost of a new spike is negligible when compared to the cost of replacing it in a relatively short time or to the damage the tie sustains from respiking. In addition, it is more difficult to maintain proper gage where throat-cut spikes have been reused, thus increasing the cost of track maintenance. Unworn spikes that have been slightly bent in withdrawing them can often be straightened and reused, but if badly bent they should be consigned to the scrap pile.

I make it a rule to use nothing but new spikes when laying rail. The extra time consumed in gaging or spiking track with partly worn or bent spikes more than offsets any difference in the cost of the new material. When the rail is laid, it should be

done in a workmanlike manner, and the best results cannot be obtained if old or second-hand material is used. There may be no serious objection to replacing a second-hand spike that is not too badly worn in a tie that is to be removed when the rail is surfaced. In a rail-laying operation, however, where every part of the work is being speeded up, so that the gangs are working under high tension, the men do not have time to distinguish between the ties that should be removed and those that are to remain in the track. For this reason, if the use of second-hand spikes is permitted, it is quite certain that many poor ones will be driven into sound ties.

In general, I would say that it is satisfactory and economical to use second-hand spikes that are only slightly worn or bent, under the limitations which have been mentioned. I would permit only new spikes to be used when laying new rail. The old spikes that are removed at this time can be sorted for loading, the usable material being segregated from the scrap and set aside for ordinary maintenance purposes.

Motor-Car Refuges

At what intervals should motor-car refuges be provided on long bridges?

Depends on Several Factors

By Engineer of Bridges

The question of motor-car refuges has been a subject of debate on our road for a long time, but without a definite decision having been made as yet. So many factors enter into the problem that a hard and fast rule can hardly be laid down which will be applicable to every case. The length and type of structure are important considerations. Platforms can be more easily constructed on a ballast-deck or open-deck trestle than on a high viaduct, yet the danger may be greater on the viaduct. The maximum speed of trains should also be taken into account and, again comparing the two types of structures, the speed of trains over the viaduct may be restricted so that the probability of a car being caught on this type of bridge is less than on the trestle.

The character of work that the men are required to do is also a consideration. If heavy tools or equipment are needed, the spacing probably should be less than where the equipment is lighter. It is also our custom to allow a greater spacing on double track bridges than on those that carry a single track, on the theory that on the double track the car should always be moving with the current of traffic. Again, the alinement approaching the bridge is a factor. If there are long tangents at both ends of the bridge we seldom provide refuges for bridges less than 1,000 ft. long, while on such structures two or three may be installed if the view is reduced because of curvature. My personal opinion is that car refuges are often provided where they are not needed. Where conditions permit, I believe it is better to provide a run-off at each end of the bridge, as the men can usually handle the car better at this place than on the bridge.

Should Be Spaced from 200 Ft. to 300 Ft.

By General Inspector of Bridges

The spacing of motor-car refuges on long bridges, or whether they shall be provided at all, depends on the conditions surrounding the structure. We seldom install them on through truss spans, because the diagonal members generally make this impractical. It is true that there is often room to do this between the inclined end posts of adjacent spans, and occasionally we place them between the fixed ends of these spans.

The amount of traffic, the speed of trains, the extent of the view at one or both ends of the bridge, the length of the spans and the number of tracks carried by the structure are taken into consideration in planning the location of the refuges. On one long structure carrying considerable traffic we have refuges spaced 281 ft., 348 ft. and several at a spacing of 275 ft. On another bridge which carries a heavier traffic a regular spacing of 200 ft. is maintained. In my opinion, if the structure is long enough to require the placing of refuges, the normal spacing should be from 200 to 250 ft., depending on the length of the several spans.

Bridge Inspectors

Should bridge inspectors be part of the local division bridge organization or should they be system employees?

Both Types of Inspectors Are Desirable

By Supervisor of Bridges and Buildings

The division bridge department is charged with the duty of maintaining the bridges on the territory to which it is assigned. In order to do this intelligently and with due regard for safety, it should know definitely at all times what the condition is of all the structures for which it is responsible. It is quite necessary, therefore, that a bridge inspector be assigned from the division forces to examine at frequent intervals all of the bridges on the division. He should be a man who can make intelligible reports and who has had ample experience in both the construction and maintenance of bridges. Preferably, he should have served as a foreman. It will add to his qualifications if he has had charge of both bridge-carpenter and masonry gangs.

He should examine in detail, not less often than monthly, all of the timber trestles, culverts and arches to determine their condition and should report on the condition of the waterways which they serve. He should also inspect all steel bridges, examining them for defects which might affect their safety or which are likely to develop into unsafe conditions.

It is seldom possible, however, to secure from among the local bridge forces a man who is thoroughly versed in the details of steel bridge construction and maintenance. For this reason, it is my opinion that, on a road of any size, there should also be a system inspector for steel bridges. In the proper form of organization, he will work with and supplement the work of the local inspector and keep both the bridge engineer and division officers informed of the condition of the more important structures and arrange for work which is beyond the capacity of the local organization.

Depends on Bridge Organization of Road

By General Inspector of Bridges

The method of employing bridge inspectors will depend in large measure on the manner in which the bridge department of the railway is organized. On a large system it is difficult if not impossible for the bridge engineer to keep in close personal touch with all of the structures under his jurisdiction. For this reason, it is logical to employ system or regional inspectors who report directly to him

or to some member of his staff who is assigned to this duty. On such a system it is probable that the bridge engineer is more directly interested in the permanent structures, particularly the steel spans and more important masonry structures, than he is in the timber bridges. Because of the multiplicity of its duties, the division engineering organization seldom is able to devote the attention to permanent structures which their importance demands. Furthermore, since any particular division seldom has more than a few such structures, it is usually impractical to assign men to the division who have the highly specialized knowledge which is required of well qualified structural inspectors.

On the other hand, timber trestles and masonry and pipe culverts come within the every-day experience of the division bridge forces and seldom require the same standard of specialized knowledge as steel bridges. In my opinion, therefore, there is a field for both types of inspection. There should be a local division inspector who is well qualified and experienced in the construction and maintenance of trestles and culverts and who should have sufficient knowledge of steel bridge work to detect any serious or important defects in these structures. He should make a thorough inspection of trestles and culverts monthly and at the same time examine all steel bridges to ascertain whether any defects exist which will impair their safety. The system or regional inspector should devote most of his attention to the more important structures but, periodically, say once or twice a year, he should go over the timber bridges and the larger arches and culverts with the division inspector.

Protecting Against Corrosion

To what extent is it practical to protect the interior surfaces of steel tanks against corrosion? What means can be employed?

Is Not Only Practical But Desirable

By J. H. Davidson
Water Engineer, Missouri-Kansas-Texas, Parsons, Kan.

It is not only practical, but in many cases absolutely necessary to protect the interior surfaces of steel water tanks against corrosion. Tanks, in common with other water service facilities, should be inspected systematically and if found to be rusting or pitting on the interior surfaces, a protection coat of some sort should be applied.

As a general rule, tanks in which cold softened water is stored do not pit or corrode as badly as tanks which are used for the storage of untreated water; but even in such tanks, serious pitting often occurs, the amount depending largely on the quality of the water.

Steel tanks used for storing hot water blown off from locomotive boilers, as in boiler-washing installations, are quite often subject to severe corrosion and have been known to pit entirely through the plates after being in service only one year.

Paints in which linseed oil is used as the vehicle are not satisfactory as a protection against corrosion, unless two or three weeks can be allowed between the application of the coats for drying. A special red-lead formula that has been used by some railways is described on page 224 of the June, 1929, issue of *Railway Engineering and Maintenance*. The same article also describes in detail the methods which have been used and the results obtained from the application of cement grout, which has proved to be especially adapted for preventing corrosion of the steel in tanks containing the hot blow-off water from boilers.

Some of the asphaltic and coal tar paints have considerable merit. Other materials in which a petroleum-jelly base is used as the vehicle for rust-inhibiting chemicals, such as chromium compounds, have given excellent results. One of the chief advantages in the use of the latter compounds is the fact that the tank can be placed in service immediately after the material has been applied.

Depends on How Long Tank Can Be Out of Service

By Engineer of Water Service

Railway water tanks are in constant service, and it is extremely difficult to take them out of service for a sufficient length of time to prepare the interior surface for the application of paints or other protective coatings, except where two or more tanks are provided. For this reason, the practicability of protecting the interior from corrosion will depend largely on the time the tank may be held out of service.

The surface of the steel should be kept dry long enough to clean the metal of all rust and accretions, apply the protective coating, and in the case of paints, allow sufficient time for the paint to dry. It is estimated that, as a rule, this will require five or six days. The time required will depend to a large extent, however, on the frequency and extent of the temperature changes which may be expected and which may cause moisture to form on the steel, commonly termed "sweating." This can be overcome to some extent by the use of salamanders or other methods of heating the tank.

Fortunately, the majority of waters do not cause rapid corrosion of the steel so long as it is under water. Any number of cases are on record of storage tanks which have been in service 25 or 30 years, which do not as yet show any extensive damage from corrosion, although they are without any protective coating below the minimum water line, other than the original shop or field coats placed on the tank at the time of erection. At the same time other tanks have shown extensive damage within a period of 10 or 15 years.

Salamanders or other methods of heating the steel have been employed to dry out the interior of tanks for cleaning and painting but even with the use of such devices it is not always possible to keep a roadside tank out of service a sufficient length of time to apply protective coatings properly without providing an auxiliary supply. As a rule, the corrosion of the interior of steel water tanks is confined chiefly to the areas exposed alternately to the action of the water and the air on account of the varying water level. This portion of the tank may be properly cleaned and the protective coating applied by maintaining the water level below the corroded area for a sufficient length of time to protect it properly.

Many different forms of protective coatings have been used in the interior of water tanks, such as prepared paints, asphaltic and coal tar paints, mastics, petroleum compounds with inhibitive chemicals, emulsified asphalts and Portland cement grout. All of these materials have been used with more or less success. One objection to the prepared paints is that they require too much time for drying. Asphaltic and coal tar paints overcome this objection to some extent, as they require a relatively short drying

period. Mastics are usually applied over a priming coat of asphaltic paint and range from ⅛ to ¼ in. in thickness, but are extremely difficult to apply. Emulsified asphalts have been used in some instances, but they have not proved entirely satisfactory. Portland cement grout has also been used frequently and as a rule has proved very satisfactory. Petroleum compounds with a dependable rust inhibitor are comparatively easy of application and offer a very satisfactory protection.

How to Tamp Ties

When ballasting track, should the ties be tamped throughout their length? If not, where should the tamping be done?

Differentiates Between New Ballast and Renewal

By J. A. Spurlock

Roadmaster, Missouri-Kansas-Texas, New Franklin, Mo.

The question does not differentiate between an original application of ballast and reballasting. Since the methods of tamping should be somewhat different in each case, I will discuss both. When an original application of ballast is being made, the track should always be raised to final grade in two lifts. On the first lift the ties should be thoroughly tamped throughout their length. On the second lift, which is the finishing lift, the raise should never be more than about two inches. At this time the ties should be tamped thoroughly at the ends and for a distance of 16 in. to 18 in. inside the rail. This leaves a space of approximately 20 in. at the center that is not tamped. The ballast should be shoveled into this opening under the tie and packed lightly to avoid a water pocket.

When reballasting, if the raise is heavy, the same procedure should be followed. If, as is usually the case, the average raise is two or three inches, the tamping should be done in the same way as specified for the second lift of an original ballast application.

Since the ties always show a tendency to compact the ballast and settle more at the ends than at the center, this method of tamping is the only means I know of to avoid center-bound track and its attendant evils. Center-bound track always results in uneven line and causes a swaying motion to cars in trains that run at high speed and eventually affects the gage, although the surface is affected to a less extent.

Favors Tamping Clear Across

By G. Stafford

Section Foreman, Canadian National, Rosebud, Alta.

Where the roadbed has fully solidified it may be possible to tamp the tie throughout its length with good results. Experience has show, however, that this condition of stability is seldom attained in actual practice, since the typical roadbed acts as an elastic foundation for the tie and ballast. Examination of a section of almost any roadbed will disclose a small but definite upward movement of the subgrade at the center and a corresponding depression toward the ends of the ties. This movement provides a condition which facilitates the formation of water pockets unless the provision for drainage is good.

The question then arises whether a change in our tamping methods would eliminate this condition. When the center tamping of ties is proposed, however, the probability of center-bound track is suggested at once. It is my experience that there is little likelihood of center-bound track developing, unless the subgrade possesses more than the usual solidity. Furthermore, if the center-bound condition should arise, it is not particularly serious, provided the general maintenance is good. Center-bound track does not develop overnight, but gives timely warning of its presence and is easily remedied. On the other hand, deformations in the subgrade may result in high maintenance costs and are extremely difficult to cure.

In my opinion, when ballasting track that rests on a subgrade that is known to be solidified, the ties should be tamped uniformly throughout their length, except for a distance of approximately one foot at the center, where the ballast should be merely filled in and packed to prevent water collecting in this space. Where the subgrade is soft, the ties should be tamped uniformly throughout. If the raise is being made in two lifts, regardless of the condition of the subgrade or the tamping methods, the centers should be fully tamped on the first lift. Again, regardless of the tamping methods used elsewhere, the first 10 or 12 ties on bridge approaches should be thoroughly tamped throughout their length.

Depends Largely on the Length of the Ties

By J. Morgan

Supervisor, Central of Georgia, Leeds, Ala.

In my opinion the proper method of tamping depends primarily on the length of the ties in use and is the same whether ballast is being applied or the track is being raised out of face for other reasons. Regardless of the reason for raising the track or the length of the ties, they should be tamped uniformly under the rail and out to the end. Where 8-ft. ties are used the tamping inside the rail should be done so as to leave a space of about 10 in. to 12 in. at the center that is untamped. This space under the tie should be filled with ballast that is lightly compacted. If the ties are 8 ft. 6 in. long the tamping should be done in the same manner, but the untamped space should not exceed 8 in. Nine-foot ties should be tamped uniformly throughout their length, although I see no serious objection to leaving a small space at the center that is not tamped quite so thoroughly.

If any stress is to be placed on the tamping at any particular point in the length of the tie, it should be at the points immediately under the rails, from there out to the ends and then for an equal distance inside the rails. Little if any benefit arises from tamping a greater distance inside the rail than outside so that, in my opinion, the amount of tamping to be done between the rails depends on the length of the ties.

Two Methods Give Good Results

By L. J. Drumeller

Division Engineer, Chesapeake & Ohio, Hinton, W. Va.

There are two methods of tamping ties when ballasting track which, in my opinion, will give equally good results. The first method is known as tamping on eight faces. In this method both sides of the tie are tamped for equal distances inside and outside the rail. It has been my experience that ties tamped in this manner result in much better riding track and require less picking up or smoothing after the work is finished.

The second method is commonly known as the lock-tamping method. It is done by tamping from one side of the tie outside of the rail and from the

opposite side of the tie for the same distance on the inside of the rail at both ends of the tie.

It is assumed that the question refers to uniform tamping throughout the length of the tie. I believe that under no consideration should the ties be tamped throughout their length. If this is done, the ballast will settle to a greater extent under the rails than at the center of the tie, thus causing center-bound track. In addition, because of this settlement, ties are frequently broken when tamped throughout their length.

Maintaining Rail Joints

In the maintenance of rail joints, what details should be given special attention?

Keeping Bolts Tight Is Important

By J. MORGAN
Supervisor, Central of Georgia, Leeds, Ala.

The most important feature of good joint maintenance is the equipping of the joints with spring washers and paying constant attention to insure that the bolts are kept tight. In doing this, however, it is important that too much tightening is not indulged in, since the bolts can be ruined by being drawn up too tightly. Furthermore, joints in which the bolts are too tight are usually frozen, with the result that no movement of the rail is possible under temperature changes.

With the modern designs of joints which are in use today, if the bolts are kept at the proper tension, and other features of maintenance are properly cared for, little or no more maintenance is required at the joint than for any other part of the rail. If slot spiking is permitted and the rail creeps, the joint is almost certain to kink out of correct line as a result of the sluing of the ties, unless a sufficient number of anti-creepers have been applied to the rail, particularly opposite the joint. This condition can generally be corrected, however, by not slot spiking the joint.

Should Be Protected Against Creepage

By G. W. EVANS
Section Foreman, Missouri-Kansas-Texas, Elgin, Tex.

One of the most important points to consider in the maintenance of rail joints is that of expansion. This should be attended to at the time the rail is laid, and it should be adequate and uniform. A sufficient number of anti-creepers should be applied immediately to keep the expansion uniform.

In this connection it might be well to mention one error into which many trackmen fall. The temperature of the air may not be the temperature of the rail at any time of the day. In many sections of the country the temperature of the air may rise rapidly during the morning hours, but the temperature of the rail seldom keeps pace with it. Likewise in the afternoon, or if it clouds over, the temperature of the air may fall more rapidly than that of the rail, so that the temperature readings should always be taken on the rail itself in order to calculate the proper expansion.

The proper tension of the bolts is also important. They should never be allowed to become loose, nor should they be wrenched up to the limit or the joint will become frozen and the allowance made for expansion will be nullified. The joint, being the weakest part of the rail, should have a firm support at all times, so that the condition of the joint ties should never be neglected. They should be sound and well tamped, properly spaced and not allowed to shift or slue.

Slot spiking is detrimental to good joint maintenance for the reason that, if the slots are spiked, any creepage of the rail will tend to shift the ties in the direction of the rail movement. This is particularly true on single track where the rails frequently creep in opposite directions, in which case both the line and gage are affected. Furthermore, the shifting of the tie carries it off its tamped bed, resulting in low joints and an increase in the rail batter. If the drainage is poor and the ballast tends to hold water, pumping joints will ensue.

If the joint is allowed to remain low for even a short period, the rate of batter increases and the joint fastenings probably will take a permanent set, so that the only remedy is to renew the fastenings in order to minimize the abuse of the rail.

Avoid Conditions Which Cause Batter

By W. C. ROURKE
Section Foreman, Texas & Pacific, Waskom, Tex.

While the standard of joint maintenance followed by the track forces of any road generally depends on the maintenance standards as a whole, the kind and weight of rail and the type of joint fastenings have a definite bearing upon what can be accomplished by the section forces. Care should be exercised to insure that the expansion is correct and uniform. The smaller the gap between rail ends, the easier it is to maintain the joint, this being particularly true with reference to rail batter. If too much expansion is allowed, both the rails and the joint fastenings are likely to attain a permanent set in a short time and the rail is ruined.

One of the frequent causes of poor joints and damaged rail is loose bolts. Bolts should always be kept tight and the fishing surfaces of the rail and joint should be kept well oiled to insure slippage during expansion or contraction of the rail. With proper tension in the bolts and well oiled fishing surfaces, frozen joints will be unknown.

I have been able to reduce the amount of pounding on suspended joints by shifting a tie under the rail ends, allowing both rails to rest on a single tie plate, and then "cocking" the joint from one-quarter to one-half inch, allowing the adjacent ties to swing. After a few trains have passed, the ties were returned to their former positions and tamped.

Joints should never be slot spiked, since this practice almost invariably results in shifted or slued ties, and low or pumping joints.

Every Detail Is Important

By ASSISTANT DISTRICT ENGINEER

In maintaining rail joints, no detail should be neglected which will tend to preserve the rail and joints and provide smooth-riding track, but all should be given equal attention. No one operation can be neglected except at the expense of other details. For example, if foul ballast is allowed to remain under a joint, it is quite certain that pumping joints will develop. Where this condition exists, no amount of tamping or of bolt tightening will make it possible to maintain the joint properly or eliminate damage to the rail and joint fastenings.

There are several details which must be given consideration in maintaining joints, all of which are of approximately the same importance and, as has been explained, are interdependent. The quality of the ties supporting the joint, the condition of the

ballast and the provisions for drainage should be watched carefully. The bolts should be kept tight and replaced, if worn. Spikes used at joints should be unworn and properly driven. The joint fastenings should have a full section and fit the fishing surfaces tightly. If the rail ends are chipped or battered they should be built up to proper surface. The line, surface and cross level at joints should be as nearly perfect as is possible. Rails that are line or surface bent, particularly in the "short quarter," should be replaced, as this defect makes joints exceedingly hard to maintain.

Restoring the Subgrade

Preparatory to ballast removal, is it advisable to restore the shoulder of the subgrade? If so, should the shoulder be raised above the bottom of the old ballast? What precautions, if any, should be taken?

Depends on Depth of Old Ballast

By G. W. Evans
Section Foreman, Missouri-Kansas-Texas, Elgin, Tex.

In the majority of cases the shoulder of the subgrade should be raised in preparation for reballasting. Whether it should be raised above the foot of the old ballast depends, however, on the depth and character of the ballast. If the old ballast is burnt gumbo, which has become practically pulverized through long service and weathering, it will not hold water, nor does water penetrate it easily. When this kind of ballast or any other kind that does not absorb or hold water is to be renewed, a better job can be obtained by building up the shoulder to the level of the bottom of the ties.

On the other hand, if the old ballast is porous and will allow water to percolate through it, the shoulder should not be brought higher than the foot of the ballast, to insure proper drainage. Otherwise soft spots will develop as a result of boxing in the ballast.

Good Judgment Is Required

By Engineer Maintenance of Way

In my opinion the first part of the question is not open to debate. Under every condition with which I am familiar it is an essential of good maintenance that the subgrade shall be of uniform height and width. For this reason it is important that the shoulder of the subgrade be restored in preparation for reballasting. In the intervals between the reballasting of any section of track, even on the best maintained roads, although particularly true on roads that do not have a high standard of maintenance, the subgrade is likely to become low and uneven from washing and other causes. If reballasting is undertaken without restoring the shoulder, the ballast toe line will be irregular and a large amount of the ballast will be wasted.

For these reasons, it is essential that the subgrade be brought to standard height and width. This should include the widening and the roughing in of the side ditching in cuts, so that they can be cleaned out and finished after the ballasting is completed, without the necessity of handling the excavated material over the new ballast.

Low places in the subgrade should never be raised above the foot of the ballast with earth or other impervious materials. If the old ballast is gravel, it is often quite satisfactory to crib out the track and break down the shoulder, disposing of the material in such a way as to build up the subgrade to the standard height and width. If of stone, the track should be dug out in the same manner and the ballast cleaned. The good stone should be returned to the track and the screenings can be used to level up the subgrade. If the subgrade is low, and economy in the use of ballast requires that the shoulder be built up above the foot of the old ballast, it can be brought up to this elevation with earth, but above the foot of the ballast, porous materials, such as cinders, granulated slag, sand or inferior material from a gravel pit, which will insure good drainage, should be used.

One of the most common causes of pumping joints is the boxing in of the track by raising the shoulder of the subgrade with impervious materials placed above the bottom of the ballast. Another result of this detrimental practice is the formation of soft spots which sometimes cost large sums to cure and which in some instances never are cured.

Restoring the Shoulder Saves Ballast

By Assistant District Engineer

It is advisable to restore the shoulder of the subgrade when ballast renewals are being made, if the ballast becomes so deep that it is no longer possible to maintain a standard ballast section, or if it is no longer possible to hold the ballast shoulder up to the tie without the use of an excessive amount of ballast. Wherever the restoration of the shoulder is neglected, the ballast will work away from the end and from under the tie, causing poor-riding track, and defeating one of the purposes for which the ballast renewal is made.

If it is necessary to restore the shoulder of the subgrade so as to maintain a standard ballast section, it is usually necessary to raise this shoulder above the bottom of the old ballast. The old ballast is seldom removed from under the tie down to the original subgrade, so that the continual application of new ballast creates a condition which makes it necessary to raise the shoulder of the subgrade above the foot of the old ballast. The general practice is to start the ballast raise on the old bed.

It is seldom necessary to take any special precautions in the work of restoration. The material used for this purpose is usually locomotive cinders or the old ballast which has been cribbed out from between the ties and broken down from the ballast shoulder. This material is porous enough to provide ample drainage and thus will not affect the track.

Shoulder Should Always be Restored

By G. A. Carroll
Division Engineer, Chicago, Rock Island & Pacific, Dalhart, Tex.

It is essential that the shoulder of the subgrade be restored as ballast is renewed from time to time. Shrinkage, erosion and other effects of the elements, sluffing and many other causes all tend to narrow, round off and wear down the shoulder until it becomes quite irregular in both elevation and width. If it is not restored to its original height and width, the shoulder and toe line of the ballast will be badly distorted and a neat and workmanlike job cannot be obtained. In addition, a considerable amount of ballast is sure to be wasted down the slope of the embankment or in filling up the low places in the subgrade.

In making this restoration, two conditions are involved, and these will determine whether the shoul-

der should be raised above the foot of the old ballast. If the old ballast contains some good material, this should be forked over or screened and thrown into the center of the track and the discarded material used to restore the shoulder. If no part of the ballast is fit for further use, the track should be skeletonized and again this material is available for use on the shoulder. It is poor judgment to try to re-use poor ballast or mix it with good material, because in a relatively short time poor riding track will result.

If the old ballast is of inferior quality, the subgrade should be brought up to the bottom of the tie before the new ballast is applied. In this case there is little danger that the old ballast will be boxed in, since in most cases it contains a large proportion of dirt and has already ceased to function as ballast.

Slipping on Platforms

What, if any, practical means can be taken to guard against slipping or tripping on floors and platforms at passenger stations?

Care Should Be Used in the Design

By Engineer of Buildings

It is an interesting fact that the majority of accidents which occur around passenger stations are the result of the colliding of persons where traffic is dense, or from slipping or tripping on floors, stairways or platforms. The results from the first cause can usually be minimized by separating the currents of traffic as much as possible. This may not always be possible in existing stations, but, even here, slight alterations may permit this to be done, or sometimes a change in the method of operating the station is all that is necessary.

The greatest hazard from tripping or slipping always occurs on stairways, while ramps and other inclined surfaces are responsible for many other such accidents. Stairs should be designed with the proper relation between risers and treads. The treads should be of sufficient width to give a proper foothold, but should not be so wide as to make their use fatiguing. The top of the tread should be smooth but should have a natural non-slip surface. If it does not possess this quality naturally, safety treads should be applied to give the proper resistance to slipping. It is important that stairs should be properly maintained to avoid the occurrence of worn and uneven surfaces which are almost certain to cause accidents. Again the corners of the treads should be sharp or only slightly rounded to minimize the chance of slipping if a full foothold is not obtained. Handrails should be provided on each side of the stairs. If they are wide, they should be divided into lanes which are separated by handrails supported on standards.

For floors there is a wide variety of materials which are satisfactory from the standpoint of appearance and which offer resistance to slipping. Tile, mosaic, terrazzo and concrete are commonly used for important stations and wood floors at the less important points. Where concrete is used, a smooth troweled surface should not be permitted, but a rough finish obtained.

On concrete platforms it is desirable to use some abrasive material, such as carborundum, in the finishing coat. The surface should be even without projections or obstructions which cannot be seen readily by persons walking in a crowd. Brick presents a rough surface except when covered with frost or sleet when it becomes quite slippery. For this reason, it is important that some protective measure, such as sprinkling sand or other granular material over the platform, shall be employed when this occurs.

Good Maintenance Is Necessary

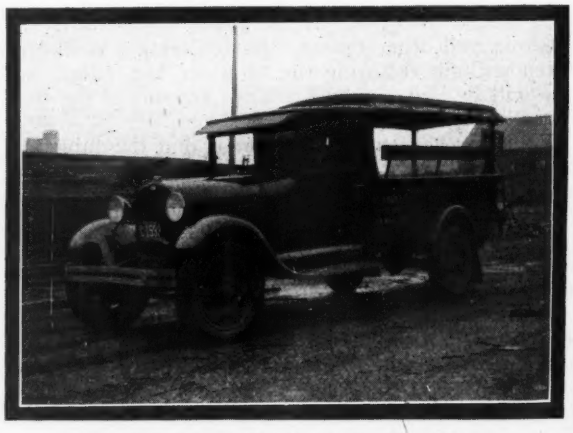
By Supervisor of Bridges and Buildings

Persons using passenger stations are usually engrossed in procuring tickets, looking after their baggage, rushing to trains or meeting friends. As a result they are generally quite heedless in their movements. It is desirable, therefore, that all passageways be unobstructed, that all floors be at the same level or joined by easy ramps, and that slippery or uneven floor surfaces be avoided.

When it is necessary to do repair work, the area affected should be properly barricaded and no loose material or tools allowed outside the barricade. Signs giving plain directions for using temporary routes should be displayed conspicuously. Care should be exercised to see that workmen do not deliver or dispose of materials without proper protection, and that no liquids or slippery substances are allowed to get on the floor.

Worn or broken places in floors or platforms should be repaired at once and worn stair treads should be repaired or replaced. If the stairs are more than eight feet wide, lanes about three feet in width should be provided by means of intermediate handrails fastened rigidly to upright standards. Where terrazzo or mosaic floors become slippery from long use, it is sometimes possible to refinish them with a grinding machine. Hard surfaced tile, mosaic or terrazzo floors should be kept dry at all times, since they are apt to become slippery when wet, or covered with a film of mud during wet weather. For the same reason soap powders should never be used in cleaning them, since practically all of the soap powders used for this purpose contain some grease that remains on the floor surface and cannot be removed by mopping or rubbing.

Most of the accidents of the character suggested by the question can be avoided by proper attention to maintenance. On the other hand, no amount of attention to maintenance can correct such errors in design as abrupt projections, improper relation of risers to stair treads, ramps that are too steep or floor materials that are unsuited for the purpose for which they are used. These factors should be given careful consideration at the time the station is designed.

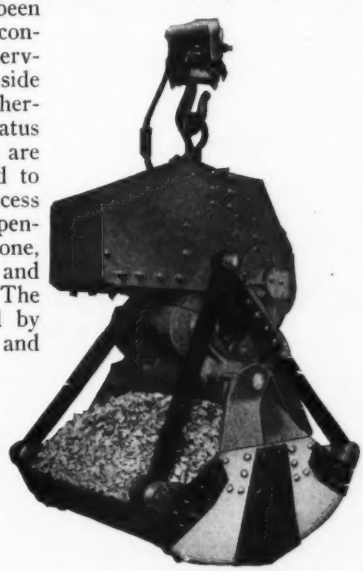


A B. & B. Motor Truck on the New Haven

NEW AND IMPROVED DEVICES

An Electric "Hook-On" Bucket

A NEW electrically-operated, power-arm type, clam-shell bucket, known as the Strayer Electric, has been developed and is now being placed on the market by the Erie Steel Construction Company, Erie, Pa. This bucket has been designed for either continuous or hook-on service and for either inside or outside work, wherever hoisting apparatus and electric current are available. It is said to handle with success coal, coke, broken open-hearth slag, sand, stone, cement, clinkers and other materials. The bucket is controlled by the crane operator and is made ready for service by slipping the hoist block hook into the holding yoke of the bucket and plugging in the electric cable.



The New Strayer Electric Bucket

Briefly, the operating mechanism of the bucket consists of an electric motor connected directly to a drum by a worm-gear drive which winds or unwinds a cable, thereby opening or closing the bucket. The bucket is constructed entirely of steel and the scoops are well banded and reinforced with cutting lips of high carbon or manganese steel extending to the top of the side plates. Teeth can be attached to the lips if it is desired to dig hard material. Corner bars are solid forged members which connect the head rigidly to the steel corner brackets that are riveted to the sides and ends of the scoops.

This bucket is manufactured for either direct or alternating current and may be used on cranes which are already wired for lifting magnets. In this case, it is said that no additional wiring is required, providing the conductors are of sufficient capacity. The bucket may be attached to cranes, monorail hoists, or any hoisting equipment wherever electric current is available. It is claimed that no adjustment is required in the field and that all mechanical parts are fully protected from the elements.

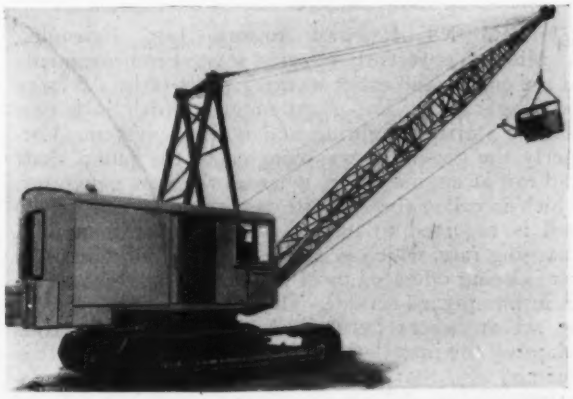
It is said to be unnecessary for the operator to exercise any particular care in shutting off the current when the bucket is closed, as an automatic feature permits the motor to stall at predetermined safe value of torque, sufficient to maintain the bucket in a full closed position. When the bucket is fully closed, the power is shut off and the automatic brake becomes set, thereby preventing the bucket from opening until the motor is reversed.

In operating the bucket, it is lowered on the material to be excavated, the control lever is moved to the closed position and the bucket is slowly lowered while closing. A slight movement of the control handle to the open position empties the bucket of all or part of the load as desired. The bucket is said to be smooth in action and to dig as much or as little as the operator desires. Other important features claimed for the bucket are the fact that it may be attached or detached in a minute and that it works within its own height. The bucket is manufactured in capacities of ¾ cu. yd. and up.

Northwest Develops New Two-Yard Dragline

A TWO-CUBIC yard dragline, designed for drainage and general construction work, has been developed and placed on the market by the Northwest Engineering Company, Chicago. This unit has a two-cubic yard bucket on a 50-ft. boom with a radius of 40 ft. and is equipped with crawlers 17 ft. 5 in. long with treads 33 in. wide. This gives a bearing area which is said to be sufficiently large to carry the machine over extremely soft ground. A 200-gal. gasoline tank assures an ample fuel supply for the machine.

The power plant consists of the Northwest variable-speed motor, which is accelerator controlled. The clutches are shifted through a "feather-touch" control and all high-speed shafts are mounted on ball bearings. The drive from the engine is made through



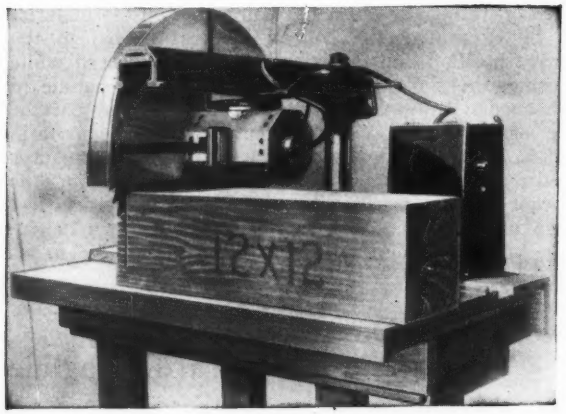
The New Two-Cubic Yard Dragline of the Northwest Engineering Company

helical gears mounted on ball and roller bearings and running in oil. Positive traction is said to assure easy maneuvering, even when turning. This machine can be loaded on one flat car with no major dismantling.

New Power Saws

THE DeWalt Products Corporation, Lancaster, Pa., has developed new portable heavy-duty cutting equipment in two models; the Model L being of sufficient size to work on 12-in. by 12-in. material, and the Model T on 12-in. by 20-in. material.

Each saw is mounted on an arm and moves horizontally, being thrust into the material with a hand ratchet gear feed or by a chain feed on the arm of the machine. The arm may be raised or lowered to the depth of the desired cut, and saw blades up to 36



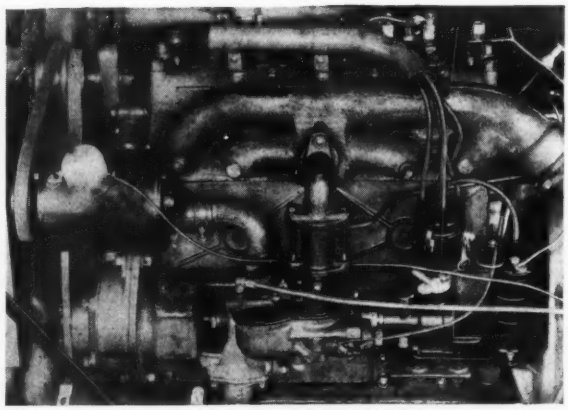
The Model L Heavy-Duty Saw

in. are provided to handle 12-in. by 20-in. material. A 16-in. dado head may be used to dado up to 3 in. The blades operate at 1,750 r.p.m. and are direct-driven by motors operating on either two or three-phase curent of 220 to 550 volts. The Model T is mounted on a metal table, equipped with steel conveyor rollers for the easy handling of heavy material. An elevating device operated by a wheel in front of the table is provided, which gives rapid elevation and ease in operation.

Improvements Effected in Large Extra-Gang Car

FAIRMONT Railway Motors, Inc., Fairmont, Minn., has recently effected several improvements in the engine and other working parts of its A5 large extra-gang car, important among which is a new electric starting, lighting and ignition system. Formerly the generator was coupled to the pump shaft and ran at engine speed, whereas the new generator, which is called the Autolite generator, is belt driven and is reported to have a much higher maximum charging rate, which is said to be required where the car is being operated most of the time at slow speed, as in hump-yard service. The charging rate can now be set anywhere between 2 and 18 amperes, thus adapting the installation to any class of service. It is claimed also that from 12 to 14 amperes can be developed when the car is idling or running only 12 miles per hour, which large current supply is said to make it possible to use both headlights to illuminate emergency night jobs, by idling the engine with the car standing.

Two additional improvements have also been recently effected. One of these is a brake lock which

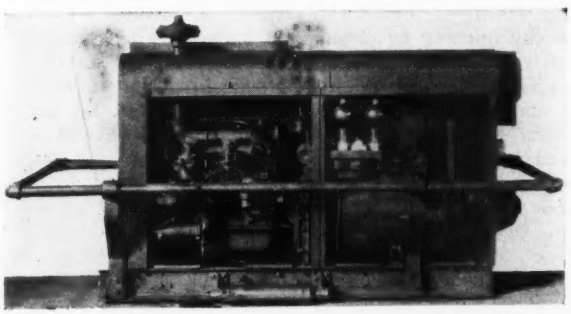


Showing the New Generator Installation for the A5 Large Extra-Gang Car

has been installed to hold the car stationary when the lever is hooked back. The other is a drop-forged, 7/16-in. manganese steel tire which has been developed to provide for unusually severe conditions and which is said to be more economical owing to its longer service.

A New Power Plant for Syntron Tie Tampers

A PORTABLE power unit of various capacities, on which the hood has been extended to cover the generator and thereby provide protection against the weather, is the latest development of the Syntron tie tamper power unit, which is manufactured by the Syntron Company, Pittsburgh, Pa. This unit is now made in 3½, 7½, 12, 15 and 20-kv. a. sizes, which are capable of operating continuously 2, 4, 6, 8 and 12 tie tampers respectively. The 7½, 15 and 20-kv. a. units have high-frequency exciter sets which excite the generators and also furnish power to run the high-



A View of the 12-kv. a. Power Unit

frequency blower motor which is located in the handle of each tie tamper. The 12-kv. a. and the 3-kv. a. units have direct-connected exciters, a frequency changer set being supplied to furnish power for the blower motors. The electrical equipment in all these models is manufactured by the Westinghouse Electric & Manufacturing Company.

In addition to furnishing power for tie tampers, these power units may be used to operate electric spike driv-

ers, hammers, wrenches, portable rail hack saws and rail drills. It is said that the units are light in weight and small in size and may be handled by five or six men. In order to facilitate rolling them up a tie or plank on to the rail, the units are mounted on skids with side rollers which are wide and low so the plant can be rolled over platforms and rail crossings. In addition, hand rails are provided to facilitate moving, and the narrow width of the units is said to obviate the necessity of providing cribbing or special set-offs, as they may be set on the shoulder of the embankment, leaving plenty of clearance for passing trains.

Some New Carbide Lights

TWO NEW portable carbide lights have recently been developed by the National Carbide Sales Corporation, New York, one of which is known as the National Carbide V.G. light and the other as the National Carbide V.G. Handy-light. These lights are designed principally for use in construction, repair and emergency work. It is claimed that there

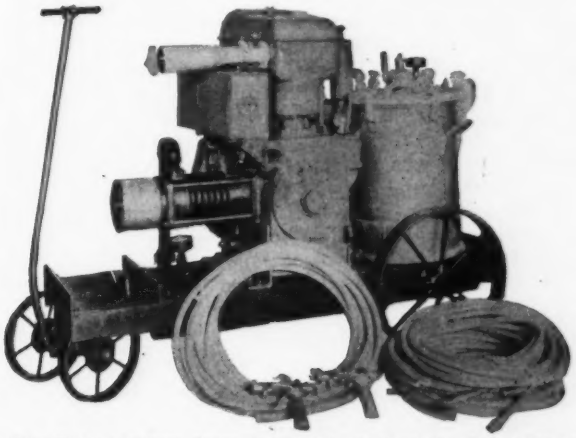
The Lights Are Compact and Self-Contained

is no after-generation in the lights and that the complete charge of carbide may be used without waste, even though the lights are used only an hour at a time, as the water and the carbide are sealed in separate compartments and the carbide is fed into the water only as needed.

The V.G. light is about 4 ft. 6 in. high, weighs approximately 30 lb. when empty and about 75 lb. when fully charged, and is said to burn about nine hours on one 5-lb. charge of 14 N. D. (granulated) carbide. This light has a 12-in. reflector that is attached to a swing joint which may be shifted to focus the light in any position. Since much of the weight is concentrated near the ground, the light may be set up almost any place and is not easily tipped over. This light has a candle power of 8,000 while that of the V.G. Handy-light is 1,500. The Handy-light weighs about 23 lb. when fully charged, burns five hours on one 1½-lb. charge of 14 N. D. carbide and has an eight-inch reflector. These lights are self-contained and are simple in construction.

New Light-Weight Air Compressors

TWO NEW models of portable air compressors have been put on the market by P. K. Lindsay & Co., Inc., Boston, Mass., which are adapted for a wide range of work requiring compressed air, and which are unusual primarily in their relatively light weight per unit of output. The larger of the two new models, which is designated E-20, and which weighs only 480 lb., consists essentially of a compressor unit mounted directly on top of a 7-hp. gasoline engine, the two units being supported on a low steel carriage frame with four flat tread wheels. A feature of the engine-compressor arrangment is that compressor drive gears, belts and couplings are eliminated, as is also the necessity for an additional crank case and crank shaft. The displacement of this



The E-20 Lindsay Compressor Mounted with a Paint Spray Outfit

model is 30 cu. ft. of free air per minute, which is sufficient to operate three paint spray guns, each with an air consumption of 7.5 cu. ft. per min. at 60 lb. pressure.

The smaller of the new models, which is known as Model E-10, is similar in design to the larger capacity unit, but has a 3-hp. driving motor and a displacement of only 18 cu. ft. of free air per minute. This unit weighs only 195 lb. complete. An interesting feature of both new models is that each delivers its full rated capacity while operating at a speed only two-thirds of that at which the engine develops its maximum power. This factor in design not only provides an unusual amount of reserve power in the units, but minimizes the strain under which the engines are operated.

TWENTY-FIVE YEARS AGO.—The eighteen-hour train between New York and Chicago, the Twentieth Century limited, made its first run on June 18. The first trains run at the increased speed were reported as much as 20 minutes ahead of time at some division terminals on that road. The trains on both the Pennsylvania and the New York Central have only four cars.—*Railroad Gazette*, June 23, 1905.

WITH THE ASSOCIATIONS

Roadmasters' Association

A meeting of the officers and members of the Executive committee, together with the chairmen of the technical committees, will be held at the Hotel Stevens, Chicago, on Saturday, June 28. In addition to receiving and acting on the report of the Arrangements committee relative to plans for the next annual convention, consideration will be given to the selection of special speakers to address the convention and the completion of the program in other respects. The tentative reports of the various technical committees will also be presented and reviewed by the Executive committee preliminary to their completion for presentation at the convention.

Wood-Preservers' Association

Approximately 75 members of the association and of the A. R. E. A. Committee on Wood Preservation attended the two-day summer meeting at Madison, Wis., on June 10-11, the first day being occupied with the meeting of various committees while the second day was devoted to an inspection of the work in progress at the Forest Products Laboratory.

At the meeting of the Executive committee on the first day it was reported that the proceedings are now in the hands of the printers and will be ready for distribution early in July. With these proceedings there will be published an index of all of the proceedings issued to date (1905 to 1929, inclusive). At this meeting preliminary plans were also made for the program for the next annual convention at Philadelphia and measures inaugurated to secure speakers for that occasion.

American Railway Engineering Association

Although most of the committees had already held preliminary meetings for organization and study of the subjects assigned to them, six committees held either their first or second meetings during June and four more are already scheduled to meet in July. The committees which met in June were Water Service and Sanitation, at St. Louis, Mo., on June 9; Economics of Railway Labor, at Milwaukee, Wis., on June 9; Wood Preservation, at Madison, Wis., on June 10; Grade Crossings, at Chicago, on June 20; Maintenance of Way Work Equipment, at Chicago, on June 24; and Records and Accounts, at Toronto, Ont., on June 25. In addition to these general meetings there were numerous meetings of subcommittees for the purpose of studying in detail the subjects assigned to them.

Among the committees which have meetings scheduled in July are Yards and Terminals, at Toronto, Ont., on July 14; Masonry, at Buffalo, N. Y., on July 16-17; Track, at White Sulphur Springs, W. Va., on July 21-22; and Rules and Organization, at Niagara Falls, Ont., July 25-26.

In addition to these general meetings of committees, the Committee on Stresses in Track is preparing for a series of important tests of rail joints on the lines of the Pennsylvania, the Baltimore & Ohio and the Delaware, Lackawanna & Western, which will be made during July.

The Proceedings of the 1930 convention are now in the printer's hands and are expected to be ready for distribution early in July. They will contain 1,850 pages.

The demand for copies of the association's Specifications for Steel Railway Bridges continues to be so heavy that a fourth reprint of the 1925 edition is now being made.

Metropolitan Track Supervisors' Club

The annual meeting and outing of the Metropolitan Track Supervisors' Club was held on June 14 at Dorlons Point, East Norwalk, Conn., and 92 members and guests were in attendance. Through the courtesy of the New York, New Haven & Hartford, a large group of those present were given transportation from New York City in special cars. Principal events at the meeting were a shore dinner, a talk by E. E. Oviatt, engineer maintenance of way, of the New Haven, the annual election of officers and prize contests.

As a result of the election of officers, P. J. Hurlihe, supervisor, New Haven, was elected president; J. R. MacAsy, general roadmaster, Erie, was made first vice-president; F. J. Biltz, supervisor, Reading, was elected second vice-president; and W. E. Gadd, Rail Joint Company, was continued in the office of secretary-treasurer. The following men were elected to the Executive Committee: W. R. Hillary, National Lock Washer Company; W. O. Dennis, maintenance inspector, Lehigh & New England; and P. R. Bickford, supervisor, Reading.

The next meeting of the club will be held on October 16 at the regular place of meeting, 72 West Thirty-sixth street, New York City, at 6:30 p. m.

Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 21-23, 1930, Louisville, Ky.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 59 East Van Buren street, Chicago. Next convention, March 10-12, 1931, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, Washington, D. C. Next convention, January 27-29, 1931, Philadelphia, Pa.

Bridge and Building Supply Men's Association—W. H. Lawrence, secretary, Johns-Manville Corporation, 41st street and Madison avenue, New York. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds, secretary, Syndicate Trust Building, St. Louis, Mo.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 16-18, 1930, Chicago.

Track Supply Association—L. C. Ryan, secretary, Oxweld Railroad Service Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

On the Eastern Division of the St. Louis-San Francisco.

RAILWAY NEWS BRIEFLY TOLD

Motor, hand and push cars are the subjects of a circular which has been issued by the National Safety Council, Chicago. This circular is designated as No. R R-1 of the Industrial Safety Series and embodies the views of safety specialists as to the precautions that can best be taken by track-car operators against injury to employees or to wayfarers at highway crossings.

Statistics which have recently been compiled by the Bureau of Railway Economics show that the Class I railways in 1929 purchased the following percentages of the total production in the United States in 1929 of certain commodities: About 25 per cent of all coal; approximately 20 per cent of all the forest products; 19 per cent of all the iron and steel; 19.2 per cent of the oil procured for fuel purposes; and 2.4 per cent of the cement.

As a result of activities during the last 10 years in connection with the welfare of employees, which include the application of the elastic work day and other improvements, the labor turnover in all departments of the Delaware & Hudson has been reduced 78.2 per cent, and 88.2 per cent in the maintenance of way department, and the depression of the last several months has been weathered without any man losing his job, according to L. F. Loree, president of the D. & H.

The Union Pacific System Athletic League, which is composed of all the athletic clubs on that system, is made up of 52 clubs having a total combined membership of 18,000 employees. Since November, 1925, the league has grown from a nucleus of 12 clubs having a membership of 1,500 employees. A typical example of the growth of the clubs throughout the system is that of the club at Laramie, Wyo., which was organized in 1926 with little resources and which now owns a club house which cost more than $18,000, has assets totaling $40,000, with an indebtedness of $13,000, and an annual income of about $8,000.

Parked sleeping cars were used by the Canadian Pacific and the Canadian National to accommodate 14,500 persons during the meeting of the Imperial Council of the Nobles of the Mystic Shrine at Toronto, Ont., on June 9, 10, 11 and 12. The Canadian National utilized an existing coach yard for the storing of 375 Pullman cars, while the Canadian Pacific constructed a new yard with a capacity of 280 cars for this purpose, both of which were located in the business section of Toronto, convenient to the exhibition grounds where the sessions of the Shrine were held. Both yards were complete communities in themselves, being equipped with such conveniences as restaurants, telegraph and telephone service, barber shops, beauty parlors, water supplies and sanitary facilities.

The American Iron and Steel Institute, New York, has just issued statistics showing that the production of angle splice bars in 1929 was 194,225 gross tons, an increase of 10,620 tons over the 1928 figure, while the production of tie plates was 603,758 gross tons, an increase of 60,652 tons over the production in 1928. On the other hand, the production of fish plates last year was 3,700 gross tons, which was a decrease of 1,682 tons under the previous year's production, and the production of other rail joints was 16,929 gross tons, this being a decrease of 4,341 tons under 1928. The statistics also show that the production of steel railroad ties in 1929 was 13,718 gross tons, which is only a slight variation from that in any year since 1925, with the exception of 1928, being 1,452 tons greater than in that year.

The hundredth anniversary of the granting of the charter of the Boston & Lowell railroad was celebrated at Lowell, Mass., on June 5 by the Boston & Maine in co-operation with that city. This celebration was called the centenary of New England steam roads, as the three-mile Granite Railway which was built near Boston, Mass., in 1826 and which was the first railroad in the United States, was operated by horses and by gravity. The Boston & Lowell, which is 26 miles long and extends between Boston and Lowell and which is now part of the main line of the B. & M., was not opened until June 24, 1835. During the five years intervening between 1830 and that date, two other roads, the Boston & Worcester (now part of the Boston & Albany) and the Boston & Providence (now part of the New York, New Haven & Hartford) had been chartered, built and opened for business as New England steam railways.

Freight Traffic

Records of the Interstate Commerce Commission show that the amount of freight hauled by the railways of the United States is undergoing radical change. For the 10 years ending with 1910 the increase in tons of freight originated was 73 per cent, or about 43,000,000 tons annually; for the 10 years ending with 1920 the increase was 22 per cent, or about 23,000,000 tons annually; and for the 9 years ending with 1929 the increase was only about 6½ per cent, or 9,100,000 tons annually. Other figures show that the average annual increase in the ton-mileage in the 10 years ending with 1910 was 11½ billion; in the 10 years ending with 1920, about 16 billion, and the 9 years ending with 1929 only 4 billion.

Sons of employees of the Gulf, Mobile & Northern between the ages of 10 and 17 years have been organized into a junior safety committee and, with this committee as a nucleus, other junior safety groups have been set up in the public schools. These groups have no regularly assigned program of work, but are expected to assist the management at any time that they will be called upon to do so. So far, they have assisted in the distribution of literature and posters for a highway crossing safety campaign and have aided materially in discouraging school children from endangering themselves on railway property. None of the towns on the G. M. & N. has Boy Scout troops or junior safety councils. The management of the G. M. & N. believes that if the idea of safety is firmly fixed in the mind of the youth, it will be productive of a trained safety worker when he becomes an adult.

The Supreme Court of the United State on June 2 rendered a unanimous decision declaring to be erroneous the application of the Hoch-Smith resolution by the Interstate Commerce Commission to the reduction of rates on fresh deciduous fruits other than apples from California to eastern destinations. The Hoch-Smith resolution was passed by Congress to cause the commission to make especially low rates on the products of agriculture and other depressed industries, and, if needed, to make compensating advances in the rates of more prosperous industries. The court found that the paragraph in the resolution applying particularly to agricultural products does not "purport to make unlawful any rate which under the existing law is a lawful rate." The commission itself decided two years before its order of 1927 in the deciduous fruit case that the rates were neither unreasonable nor unduly preferential.

Construction News

Projects Contemplated

C. R. I. & P. - S. L.-S. F. — Acting on petition of Ft. Worth & Denver Northern and civic organizations of Childress, Texas, and Pampa, the I. C. C. has opened for further argument the case in which it authorized subsidiaries of the C. R. I. & P. and S. L.-S. F. to construct 150 miles new lines in Texas, to establish shorter route to Ft. Worth, Texas, and Dallas.

Corpus Christi, San Angelo & Roswell—Charter filed with secretary of Texas for construction of line between Corpus Christi, Tex., and Roswell, N. M., 725 miles.

L. & N.—Permission requested of War Department to reconstruct bridge over Cumberland river, Nashville, Tenn., $220,000.

P. & L. E.—Construction of yard office building, McKee's Rocks, Pa., $40,000.

Sacramento Northern—Authority requested of I. C. C. to extend Holland line to Ryde, Cal., 8.3 miles.

S. P.—By Cal. Highway Com. to construct highway subways, Emigrant Gap, Cal., and Cottonwood.

Term. R. R. Assoc. of St. L.—Thirteen-story merchandise mart between 12th, 13th, Spruce and Poplar sts., St. Louis, Mo., $5,000,000.

Projects Authorized

B. & O.—Brick and steel outbound and inbound freight houses, 30 ft. by 500 ft., and 50 ft. by 620 ft. respectively, Toledo, Ohio, along Ottawa st.; also passenger and freight facilities, Johnstown, Ohio, to be moved to Baumer st., where brick passenger station and brick and steel freight house, 30 ft. by 305 ft. will be built.

Bangor & Aroostook—Alterations and additions to yard, Millinocket, Me., $100,000, and renewal and strengthening of 14 bridges, $134,000.

N. Y. N. H. & H.—Additional fire protection at shops, New Haven, Conn., $40,000.

Penna.—Razing present train sheds, construction umbrella sheds, lengthening present platforms and tracks, and additional smoke protection for structure over tracks, Union station, Columbus, Ohio, $750,00.

Ulster & Del.—Elimination grade crossing, East Main and Beaver sts., Stamford, N. Y., by construction of overpass.

Approved by Commissions

D. & H.—By Pub. Serv. Com. of N. Y. to close Vials crossing, Westport, by new overcrossing 375 ft. north, $128,000.

Erie—By Pub. Serv. Com. of N. Y. to eliminate Spring Valley-Suffern highway crossing, Ramapo, by construction of overpass 150 ft. west, $116,000.

N. Y. C.—By Pub. Serv. Com. of N. Y. to eliminate Butts crossing, Brighton, by construction of underpass; also elimination of Weedsport road crossing, Brutus, by construction of overpass, $178,000.

N. Y. N. H. & H.—By N. Y. Pub. Serv. Com. to widen to 60 ft., 30-ft. roadway on Scott's bridge carrying Lincoln ave. over tracks, Mt. Vernon, road's portion $45,400.

N. Y. O. & W.—By Pub. Serv. Com. of N. Y. to eliminate crossing at East Seneca st., Oswego, by construction of 400-ft. concrete and plate girder overhead bridge, $175,000.

Penna.—By Pub. Serv. Com. of N. Y. to eliminate Sand Hill crossing, Genesee Jct., N. Y., by construction of overhead crossing, $136,000.

St. L. S. W.—By I. C. C. to construct extension from Caraway, Ark., to Truman, to acquire Arkansas Short Line, and to operate under trackage rights over M. P. between Fair Oaks, Ark., and Bridge Junction, to form shorter route from St. Louis, Mo., to Memphis, Tenn.

Bids Received

A. T. & S. F.—Until June 11 by Los Angeles (Cal.) bd. of pub. wks. for construction subway at 6th st., Los Angeles.

C. P. R.—For construction freight sheds and offices, Humboldt, Sask., North Battleford and Prince Albert.

Cent. of Ga.—For construction warehouse and office building, Marion, Ga., $25,000.

C. R. I. & P.-Wab.—By. St. L. (Mo.) Bd. of Pub. Serv. for construction 3 bridges over depressed tracks, Forest Park, St. Louis, $145,500.

C. R. I. & P.-S. L.-S. F.—For construction concrete, brick, steel and stone union station, 222 ft. by 360 ft. Oklahoma City, Okla., $2,500,000.

City of Balt., Md.—By Dept. of Pub. Wks. for construction 1,933-ft. underpass on Eastern ave. under tracks of Penna. and B. & O.—Catalano & Pecora, Baltimore, $436,677.

Ky. & Ind. Term.—Until June 25 for excavation, embankment, masonry and steel work for elevation of tracks, adjustment of industrial siding connections and construction of underpass for six streets between Market and Kentucky sts., Louisville, Ky.

S. L.-S. F.—For construction extension, Shamrock, Okla., to Drumright, 3 miles.

Contracts Awarded

Albany (N. Y.) Port Dist. Com.—Construction 30,000 ft. track on Westerloo island—Henry Dumary, Albany, to connect main lines of West Shore and D. & H. with dock front.

Algoma Cent. & Hud. Bay—Construction two 40-ft. arches and 8 culverts, Sault Ste. Marie, Ont.—Robert Lang & Sons, Sault Ste. Marie, $40,000.

A. T. & S. F.—Extension, Amarillo, Tex., to Boise City, Okla., 120 miles, as part of Amarillo-Las Animas (Colo.) line—Sharpe & Fellows, Los Angeles, Cal.; also one-story, brick bunk houses, 14 ft. by 112 ft., Peabody, Kan., and Wilder—Lundgren & Carlson, Topeka, Kan.

Beav. Meade & Engl.—Construction of line, Hough, Okla., to Keyes, 40 miles—Panhandle Const. Co., Oklahoma City, Okla.

C. N. R.—By Dept. of Rys. and Canals of Can. for construction of 2,500,00-bu. grain elevator, Churchill, Man.—Carter-Halls-Aldinger Company, Winnipeg, Man.; construction of substructure of elevator—Thunder Bay Harbor Improvement Co., Port Arthur, Ont., $300,000, total cost $2,000,000.

C. & O.—Construction 1,000-ft. by 70-ft. coal pier of concrete on concrete piles, Newport News, Va.—W. Horace Williams Co., New Orleans, La.; also construction 6,300-ft., single-track tunnel between Big Bend, W. Va., and Hilldale—Haley, Chisholm & Morris, Charlottesville, Va., $2,200,000.

C. B. & Q.—New passenger and freight stations, Streator, Ill.—John Lightholder, Streator; and 900-ton reinforced concrete automatic electric coaling station, Galesburg, Ill.—Fairbanks, Morse & Co., Chicago.

C. M. St. P. & P.—By city of Sioux Falls, S. D., for construction 900-ft. reinforced concrete and steel viaduct over tracks of C. M. St. P. & P.; C. St. P. M. & O.; and G. N., Sioux Falls—Peppard & Fulton, Superior, Wis., $160,000.

C. R. I. & P.—Ten-stall addition to enginehouse, storehouse and enginehouse office all of brick, East Des Moines, Iowa—Athur H. Neumann, Des Moines, Iowa; also water-treating plant at same point—Railroad Water & Coal Handling Co., Chicago.

C. R. I. & P.—M. P.—Construction reinforced concrete viaduct over tracks and Rose creek, Little Rock, Ark.—Luten Bridge Co., Little Rock, $127,000.

Cin. (Ohio) Union Term.—Concrete masonry for new lines of C. & O. and C. N. O. & T. P. into terminal—Kerpen Const. Co., Cincinnati, $150,000.

E. J. & E.—Construction 330-ton, two-track coaling station with coal crushing facilities, Ingalton, Ill.—Roberts & Schaefer Co., Chicago.

Erie — Grade crossing elimination structure, Cleveland, Ohio—Stevens Const. Co., Cleveland; steel and concrete, two-story pier, 1,050 ft. by 70 ft., south of pier No. 9, Jersey City, N. J.—Frederick Snare Corp., New York.

I. C.—Reinforced concrete ice-loading platform, 14 ft. by 1,484 ft., Waterloo, Iowa—Zitterell-Mills Const. Co., Webster City, Iowa.

Ill. Term.—In connection with construction reinforced concrete and steel, elevated, double-track line, St. Louis, Mo., to connect surface line on 12th st. with McKinley bridge—steel fabrication, McClintic-Marshall Co., Pittsburgh, Pa.; steel erection, Ben Hur Erection Co., St. Louis; substructure for river pier, G. Locke Tarlton Co., St. Louis; river pier and temporary freight station and office building. Fruin-Colnon Contr. Co., St. Louis, total $1,500,000.

Maine Cent.—Additions to and reconstruction of wharves, Portland, Me.—Merritt-Chapman & Scott Corp., New York, $700,000.

M. P.—Two-story reinforced concrete warehouse, Kansas City, Mo.—Patti Const. Co., Kansas City, $50,000.

N. Y. C.—Elimination of Thompson road crossing, Syracuse, N. Y., by construction of viaduct—Bates & Rogers, New York, $420,000; elimination Main st. crossing, New Hamburg, N. Y.—Walsh Const. Co., Syracuse, N. Y., $42,329; canopies and other work for milk-handling, Weehawken, N. J.—Edward J. Duffy Co., Inc., New York; reconstruction bridge T-15, Blasdell, N. Y.—E. F. Muntz, Inc., Buffalo, N. Y.

N. Y. N. H. & H.—Installation of fire-protection system on Poughkeepsie bridge, Poughkeepsie, N. Y.—Foshett & Bishop Co., New Haven, Conn., $30,000.

Pac. Great East.—Grading for 5.2 miles of new line and yard, Lillooet, B. C.—W. C. Arnett, $100,000.

Penna.—Construction side track connection to Oakley factory colony, Cincinnati, Ohio, and for grading, masonry, paving, etc., from Allegheny River bridge to 20th st., Pittsburgh, Pa.—John F. Casey Co., Pittsburgh, Pa., $169,000 and $62,000; construction circular reinforced concrete coal pockets and auxiliary equipment at Gray's Ferry ave. and Alter st. and at 29th st. and Sedgley ave., Philadelphia, Pa.—Nicholson Co., Inc., New York, $185,000 and $38,000; placing deck slabs on bridges Nos. 4.21 and 4.25 over Hackensack river, Marion, N. J.—Frederick Snare Corp., New York, $148,400; construction wye track between Cincinnati and Logansport divisions and reconstruction bridge over Mississinewa river, Ridgeville, Ind.—Mellon Const. Co., Chicago, total cost $85,000; for construction overcrossing and undergrade pedestrian subway, Seward, Pa.—Ferguson & Edmonson Co., Pittsburgh, $62,000; construction Pier F of steel and concrete at foot of Bay st., Jersey City, N. J.—J. Rich Steers, Inc., New York.

Pere Marq.—Substructure for two fixed spans and one movable span for steel bridge, Port Huron, Mich.—Jutton Kelly Co., Detroit, Mich.; fabrication and erection superstructure—American Bridge Co., New York; total cost of bridge, $500,000.

P. & W. V.—Construction 6 miles line from point on Connellsville extension near Pigeon creek to connection with Donora Southern, Baird, Pa.—Vang Construction Co., Cumberland, Md., $1,500,000.

St. L. S. W.—Grading for line, Truman, Ark., to Caraway, 15 miles—Reid & Lowe, Birmingham, Ala.

Sou.—Water treating plant, Shelbyville, Ky.—R. D. Cole Manu. Co., Newman, Ga.

U. P.—Construction concrete lined reservoir, Hanna, Wyo.—Ryberg Bros., Salt Lake City, Utah, and Morrison Knudson Co., Boise, Idaho.

Virginian.—Sections A and B of new bridge over Kanawha river, Deepwater, W. Va.—Boxley Bros. Co., Inc., Orange, Va.

Va. & W.—Seven miles new line, M. P. 26 to M. P. 33, Guyandot River line from Elmore, W. Va., to Gilbert—Walton Ludduth Company, Bluefield, W. Va.

Supply Trade News

General

The Morrison Railway Supply Corporation, Buffalo, N. Y., has moved its Chicago offices to 650 Railway Exchange building.

The **Ash Grove Lime & Portland Cement Company,** Kansas City, Mo., has moved its general offices in that city to the Fairfax building, 101 West Eleventh Street.

The Independent Penumatic Tool Company, Chicago, has purchased the **Cochise Rock Drill Manufacturing Company,** Los Angeles, Cal., which will be operated by the former company as a unit of its organization, with no change in personnel.

The Valspar Corporation, New York, has merged the **Detroit Graphite Company,** Detroit, Mich., and the **Dominion Paint Works, Ltd.,** Walkerville, Ont., with its existing units. The plans for consolidating the activities of the two companies with the other units of the Valspar Corporation do not contemplate any change in management or loss of identity in these two new subsidiaries.

The **American Tar Products Company,** Pittsburgh, Pa., has acquired the **Ayers & Lord Tie Company,** Chicago. All of the officers of the latter company will continue in their present capacities and the company will be operated as a separate unit of the controlling company. The Ayer & Lord company now operates timber treating plants at Carbondale, Ill., Louisville, Ky., North Little Rock, Ark., Grenada, Miss., and Montgomery, Ala., a tie storage plant at Brookport, Ill., marine ways at Paducah, Ky., and a creosote oil station at New Orleans, La.

The Blaw-Knox International Corporation is the new name for the export organization of the **Blaw-Knox Company,** which was formerly known as the Milliken Brothers-Blaw-Knox Corporation, which in turn succeeded the original Milliken Brothers Manufacturing Company. The change of name embraces no change in personnel and the offices will remain as formerly, in the Canadian-Pacific building, New York City. The Blaw-Knox International Corporation handles all the products of the Blaw-Knox Company in South America, the West Indies and other parts of the world where the Blaw-Knox Company is not otherwise represented.

Personal

T. A. Burns has joined the sales organization of the **Harnischfeger Corporation,** Milwaukee, Wis., with headquarters in that city.

W. L. Lewis, formerly assistant comptroller of the **Bethlehem Steel Corporation,** has been elected vice-president, secretary and treasurer of the **Chicago Pneumatic Tool Company,** New York, succeeding J. G. Grimshaw, secretary and treasurer, resigned.

James J. Crawford has been appointed representative of the Railway Appliance division of the **American Fork & Hoe Company,** with headquarters in Louisville, Ky.

H. S. Schroeder, formerly vice-president and general sales manager of the **Interstate Iron & Steel Company,** has been appointed western manager of sales for the **Republic Steel Corporation,** with headquarters at Chicago.

J. L. Rowe, manager of railroad sales of the Chicago Pneumatic Tool Company, New York, died on June 5 from injuries sustained in an automobile accident. Mr. Rowe has been with the company since 1919.

A. L. Greenabaum, vice-president of the O. F. Jordan Company, East Chicago, Ind., died at Chicago on June 4 after an extended illness. Mr. Greenabaum was born on January 20, 1880, at

A. L. Greenabaum

Wilmington, Del., and served in the navy during the Spanish American War. He also worked for various construction contractors and for a time was in this business for himself. In 1914 he entered the service of the Chicago, Rock Island & Pacific and was subsequently advanced to supervisor of work equipment and motor cars of that road. On September 15, 1920, Mr. Greenabaum left the Rock Island to become general sales manager of the O. F. Jordan Company, and in 1928 he was promoted to vice-president of that company, which position he held until his death. Mr. Greenabaum was also prominent in the affairs of the National Railway Appliances Association and was a past-president of that organization.

I. N. Benson, general supervisor of work equipment on the Boston & Maine, with headquarters at Boston, and who for 16 years has been connected with the New York, New Haven & Hartford and the Boston & Maine

in charge of work equipment, has been appointed development engineer of railroad equipment of the Bucyrus-Erie Company, with headquarters at South Milwaukee, Wis.

Russell B. Arnold, 140 South Dearborn street, Chicago, has been appointed mid-west sales representative of the **Howard P. Cook Company,** Bridgeport, Conn., to handle the Greer snow melting devices.

Elmer A. Sperry, inventor of the Sperry transverse fissure detector car and one of the foremost American engineers and inventors, died on June 16 at

Elmer A. Sperry

Brooklyn, N. Y., at the age of 70 years. Mr. Sperry was born on October 12, 1860, at Cortland, N. Y., and was educated at the State Normal School in that city, subsequently attending Cornell University for a year. He engaged in business and invention at an early age and was immediately successful. He founded the Sperry Electric Company of Chicago and the Sperry Electric Railway Company, Cleveland, Ohio, selling the latter company to the General Electric Company in 1894. His work from then on included improvements in mining machinery, electrical equipment, street railway cars, inventions in the field of electro-chemistry, the practical application of the gyroscope to steamships, the gyro-compress, drift indicators, gun-fire control apparatus, bomb-sighting devices and many other appliances. In 1929, Mr. Sperry started the Sperry Development Company, Inc., and the Sperry Rail Service Corporation. Later he organized the Sperry Products, Inc., as successor to the two last-named companies. Mr. Sperry was a member of many technical societies and the recipient of various medals in recognition of his many inventions.

William E. Balliet has been appointed manager of the Birmingham, Ala., office of the **Blaw-Knox Company,** Pittsburgh, Pa., to succeed **P. V. Kelly,** and **Joseph Riley** has been appointed assistant manager of the district. **John E. Chiquoine** has joined the sales staff of this company.

A. H. Purdom has resigned from the railroad sales department of the **Wood Conversion Company,** Chicago, and will open an office to handle railway supplies. **Benjamin B. Shaw** has been appointed sales representative in the railroad department, with headquarters at Chicago.

George H. Lanborn, formerly production manager of the Chicago plant of the **Morrison Railway Supply Corporation,** Buffalo, N. Y., has been appointed supervising engineer of the manganese frog and crossing reconditioning department of that company, with headquarters at Chicago. **R. B. Alfonte** has been appointed assistant to the manager of the Chicago office.

G. F. Blackmer, general superintendent, and **J. A. Coakley,** general traffic manager of the **American Steel & Wire Company,** have been appointed vice-presidents, with headquarters at Cleveland, Ohio. **B. H. Lawrence,** mechanical engineer, has been promoted to chief engineer at Cleveland, and **Frank Baaches,** vice-president at Chicago, has been appointed assistant to the president.

Trade Publications

Rock-Drill Steel.—The Sullivan Machinery Company, Chicago, has published a 48-page handbook, designated as circular No. 72-K, which contains valuable information on the selection, heating, forging and tempering of rock-drill steel. It also includes instructions for the care and use of Sullivan drill sharpeners and drill-steel furnaces.

Quarry Cars and Track Material.—The Koppel Industrial Car & Equipment Co., Koppel, Pa., has issued a 32-page booklet, which is devoted to illustrating and describing the various types of quarry cars that are manufactured by this company. Space is also given to a description of metal ties, switches, turntables and other track material which is distributed by this company.

Hayward Buckets.—The Hayward Company, New York, has recently issued Bulletins No. 645 and No. 700, which describe and illustrate products of this company. The former deals with the Class K clam shell bucket and, besides describing the bucket, depicts its various applications by illustrations. The latter bulletin contains a description of the Hayward electric motor bucket, which is a "hook-on" type of clam shell bucket that can be hooked on to any standard form of crane.

Beginning the Second Century.—This is the title of a 20-page, colorfully-illustrated booklet containing a condensed and intensely interesting history of Fairbanks, Morse & Co., Chicago. The development of the Fairbanks scale, which was invented in 1830, is dealt with first and is followed by a discussion of the circumstances leading up to the organization of Fairbanks, Morse & Co. A chapter is devoted to the history of power and the Diesel engine and the booklet closes with a chapter describing the part which Fairbanks scales play in modern industry.

Personal Mention

General

F. J. Nugent, division engineer on the Iowa division of the Chicago, Rock Island & Pacific, with headquarters at Des Moines, Iowa, has been promoted to trainmaster, with the same headquarters. He was born on April 15, 1878, at Waterloo, Iowa, and graduated from the University of Iowa with a degree in civil engineering in 1903. Mr. Nugent's railway career began with the Rock Island in 1903, when he became a material clerk at Silvis, Ill. Later he was transferred to the engineering and maintenance of way departments, being appointed roadmaster at Cedar Rapids, Iowa, in 1909. Later in that year Mr. Nugent was appointed assistant engineer with the same headquarters and in 1910 he was placed in charge of the construction of a yard at Cedar Rapids. In 1911, he was promoted to office engineer, with headquarters at Chicago, and on February 1, 1912, was sent to Little Rock, Ark., as division engineer. He then served as division engineer and office engineer on various divisions of the Rock Island, being subsequently appointed division engineer on the Iowa division, which position he held until his recent promotion, effective May 1.

J. K. Johnston, formerly principal assistant engineer on the Pennsylvania and more recently assistant general superintendent of the Eastern Pennsylvania division of that road, with headquarters at Tyrone, Pa., retired from active service on June 1. Mr. Johnston, who had served continuously for nearly 51 years with the Pennsyl-

J. K. Johnston

vania, was born on May 8, 1860, at Pleasant Unity, Westmoreland County, Pa. After graduating from Greensburg Academy he commenced his railway career in August, 1879, with the engineering department of the Pennsylvania on the location and construction of branch lines in southwestern Pennsylvania. In January, 1887, he was promoted to assistant engineer maintenance of way, with headquarters at Altoona, Pa., and on July 31, 1888, he

was appointed assistant supervisor on the Tyrone division. On November 1, 1902, Mr. Johnston was promoted to principal assistant engineer at Altoona, then being further promoted to superintendent of the Tyrone division, with headquarters at Tyrone, the following year. He was transferred to the Philadelphia division, with headquarters at Harrisburg, Pa., in October, 1917, returning to Tyrone as superintendent in February, 1928. Following the absorption of the Tyrone division by the Williamsport and Middle divisions on May 1, 1929, Mr. Johnston was appointed assistant general superintendent of the Eastern Pennsylvania division, which position he was holding at the time of his retirement.

F. D. Beale, an engineer by training and experience and superintendent of the Richmond division of the Chesapeake & Ohio, with headquarters at Richmond, Va., has been promoted to assistant general superintendent of the Western General division, a newly created position, with headquarters at Huntington, W. Va. Mr. Beale was born in 1890, at Fredericksburg, Va., and first entered railway service in January, 1910, with the Florida Railway (now abandoned) where he served as instrumentman, assistant engineer and resident engineer until September, 1911, when he resigned to enter the University of Virginia, from which he graduated four years later with a degree in civil engineering. He commenced his service with the C. & O. in October, 1915, as an assistant track foreman, being promoted to assistant supervisor of track a year later. He was appointed acting division engineer of the Clifton Forge division in May, 1917, later being promoted to division engineer of the same division. After a period of service in the United States Army during the World War, he returned to the position of division engineer of the Clifton Forge division. In February, 1924, Mr Beale entered the operating department as trainmaster, in which position he served on various divisions until March, 1926, when he was promoted to superintendent of the Richmond division, which position he held until his recent promotion to assistant general superintendent.

Engineering

C. A. Stelle, resident engineer on the Chicago & Alton, with headquarters at Chicago, has resigned.

F. R. Baldwin, assistant engineer on the Atchison, Tokepa & Santa Fe, with headquarters at Chicago, has been promoted to engineer of inventories, with the same headquarters.

I. Anderson, division engineer of the Kansas City division of the Atchison, Topeka & Santa Fe, with headquarters at Kansas City, Mo., has moved to the Argentine station, Kansas City, Kan. **E. O. Hemenway,** assistant engineer with headquarters at Chicago, has been appointed acting division engineer of the Illinois division, with headquarters at Chillicothe, Ill., to replace **T. H. McKibben,** who has been assigned to special valuation work.

A. L. Zimmerman, assistant engineer on the International-Great Northern, with headquarters at San Antonio, Tex., has been transferred in the same capacity to Houston, Tex.

L. G. Harris, construction engineer on the Coast Lines of the Atchison, Topeka & Santa Fe, has been promoted to district engineer of the Northern district of the Western Lines, with head-

L. G. Harris

quarters at La Junta, Colo., to succeed **D. E. Helvern,** who has been appointed division engineer at Pueblo, Colo., where he succeeds **O. F. Arthur,** who has been transferred to Albuquerque, N. M.

Mr. Harris was born on August 27, 1886, at Parsons, Kan., and commenced his railway career in October, 1905, as a chainman on the A. T. & S. F. at Canyon, Tex. He was then advanced through various positions in the engineering department, including that of rodman, transitman and building inspector, serving in the latter capacity on maintenance, construction and betterment work and on location surveys. In January, 1916, he was appointed acting division engineer of the Arkansas River division, being then, in the spring of 1917, promoted to division engineer of the Rio Grande division, with headquarters at San Marcial, N. M. Mr. Harris was subsequently appointed construction engineer on the Coast Lines, serving on various projects there until his recent promotion to district engineer.

R. M. Smith, assistant engineer maintenance of way on the Missouri Pacific, with headquarters at St. Louis, Mo., has been appointed division engineer of the new Southern Kansas-Central division, with headquarters at Coffeyville, Kan. The Southern Kansas-Central division was formed on June 1 by consolidating the Southern Kansas and the Central divisions. **W. F. Murray,** division engineer of the former Southern Kansas division, with headquarters at Coffeyville, has been appointed assistant division engineer of the new division, with jurisdiction over the territory of the former Central division and with headquarters at Van Buren, Ark. **C. B. Huffman,** division engineer of the former Central division at Van Buren, has been appointed assistant engineer on the Omaha-Northern Kansas division, with headquarters at Falls City, Neb., to replace **L. L. Swim,** who has been transferred to the Southern Kansas-Central division at Coffeyville. **H. H. Heasley,** assistant engineer on the former Southern Kansas division at Coffeyville, has been transferred to the Memphis division, with headquarters at Wynne, Ark., where he succeeds **A. A. Glockner,** who has been assigned to other duties.

R. E. Sherer, assistant engineer on the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Enderlin, N. D., has been promoted to division engineer of the Twin City Terminal division, with headquarters at Minneapolis, Minn., to replace **S. P. Berg,** who has been transferred to the Stevens Point division, with headquarters at Stevens Point, Wis., where he succeeds **E. E. Foster,** whose appointment as resident engineer at Minneapolis was noted in the June issue. **W. M. Olds,** assistant engineer, with headquarters at Fond du Lac, Wis., has been transferred to Enderlin to replace Mr. Sherer.

R. A. Brown, instrumentman on the Illinois division of the Chicago, Rock Island & Pacific, has been promoted to division engineer on the Cedar Rapids-Minnesota division, with headquarters at Cedar Rapids, Iowa, to succeed **W. E. Heimerdinger,** who has been transferred to the Iowa division, with headquarters at Des Moines, Iowa, to replace **F. J. Nugent,** whose promotion to train master is noted elsewhere in these columns.

Mr. Brown was born on February 15, 1902, in Kent county, Mich., and graduated from the University of Michigan in 1924 with a degree in civil engineering. He commenced his railway career in the same year as a rodman on the Cedar Rapids-Minnesota division of the Rock Island and has since been with that road continuously. In 1925, he was promoted to rodman on the survey of the proposed line of the Rock Island from Trenton, Mo., to Kansas City. On the completion of this survey Mr. Brown resumed his former position on the C. R.-M. division, where he remained until September, 1925, when he was again promoted to rodman, this time on the Iowa division. A year later he was transferred to Chicago and on March 1, 1926, he was promoted to instrumentman on the Missouri division, being then transferred to the Illinois division, where he remained until his recent promotion, effective May 1.

Track

W. W. Clarke, acting supervisor of track on the Pennsylvania, with headquarters at Marion, Ohio, has been promoted to supervisor with the same headquarters.

Michael Clarke, assistant roadmaster on the Louisville & Nashville, with headquarters at Athens, Ala., retired

on May 1 after 54 years of active service with that road.

Thomas Stewart, supervisor of track of Subdivision No. 1 of the Grand Rapids division of the Pennsylvania, with headquarters at Kalamazoo, Mich., retired on June 1 at the age of 70 years.

Alexander Hallisey has been appointed roadmaster on the Southern Pacific with headquarters at Suisun, Cal., to succeed **C. N. Myrick,** whose transfer to Niles, Cal., was noted in the June issue.

M. Ganley, roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Argentine, Kan., has been transferred to Topeka, Kan., to replace **J. O. Abramson,** who is on leave of absence on account of illness.

C. L. Nolan has been appointed supervisor of track on Sub-division No. 20 of the New York Central, with headquarters at Streator, Ill., to succeed **J. W. Sweeney,** whose death is noted elsewhere in these columns.

H. Hill, supervisor on the Cresson branch of the Pittsburgh division of the Pennsylvania, with headquarters at Cresson, Pa., has been appointed assistant supervisor on the same division with headquarters at Johnstown, Pa., to succeed **D. M. Clarke,** resigned.

S. A. Hart, supervisor on Subdivision No. 3 of the Long Island, with headquarters at Jamaica, N. Y., has been transferred to Subdivision No. 5, at Hicksville, N. Y., succeeding **H. W. Manning,** who has been transferred to Jamaica to succeed Mr. Hart.

Melvin L. Doyle, acting supervisor of track on the Akron division of the Baltimore & Ohio, with headquarters at Warren, Ohio, has been promoted to supervisor of track, with the same headquarters, to succeed **Fred Green,** who has been on leave of absence and whose death is noted elsewhere on this page.

M. Snodgrass, supervisor of track on the Illinois Central, with headquarters at Evansville, Ind., has been assigned to other duties. The territory formerly alloted to Mr. Snodgrass has been divided between **M. A. Sheahan** and **M. B. Davis,** supervisors, with headquarters at Decatur, Ill., and Mattoon, respectively. **I. D. Holmes,** supervisor with headquarters at Mendenhall, Miss., has been transferred to Durant, Miss., where he replaces **W. E. McCune,** who is on leave of absence. The position of supervisor at Mendenhall has been abolished.

T. Dixon, track foreman on the Canadian National, with headquarters at Estevan, Sask., has been promoted to roadmaster on the Regina division, with headquarters at Radville, Sask., to succeed **T. J. Patton,** who has been transferred to the Beechy, Elrose and White Bear subdivisions of the Saskatoon division to replace **C. F. Werseen.** Mr. Werseen has been transferred to Saskatoon, Sask., on the same division to succeed **W. M. Carroll,** retired. **A. E. Lyons,** roadmaster at Swan River, Man., has been transferred to Sioux Lookout, Ont., where he succeeds **R. Ferguson,** who has retired. **A. Shack** roadmaster at Melville, Sask., has been transferred to Saskatoon to replace **G. T. Bell,** also retired.

G. W. Clark, track foreman on the Western Pacific, with headquarters at Redhouse, Nev., has been appointed roadmaster on the Tidewater Southern, with headquarters at Modesto, Cal. Mr. Clark was born on March 20, 1893, at Grantsville, Utah, and was educated at the University of Utah and George Washington Medical College, Washington, D. C. He commenced his railway career on October 28, 1924, as a timekeeper in the engineering department of the Western Pacific, with headquarters at Timpie Quarry, Utah, being transferred to the bridge and building department on July 5, 1925, and thence to the maintenance of way department on March 1, 1926. On May 6 of the same year, Mr. Clark was appointed bridge and building and roadmasters' clerk at Elko, Nev., and on September 12, 1927, he was appointed shop accountant with the same headquarters. On March 16, 1928, he was transferred back to the maintenance of way department as a track man in the Elko yards, and on April 16 of the same year he was promoted to track foreman at Redhouse.

Bridge and Building

T. E. Downard, supervisor of bridges and buildings on the Gulf & Ship Island division of the Illinois Central, with headquarters at Hattiesburg, Miss., has been transferred to the Kentucky division with headquarters at Louisville, Ky.

D. E. Saurer, assistant master carpenter on the Ft. Wayne division of the Pennsylvania, has been appointed master carpenter on the Chicago Terminal division, with headquarters at Chicago, to succeed **A. F. Miller,** retired. **H. R. Morris,** carpenter foreman on the Indianapolis division, has been promoted to assistant master carpenter on the Ft. Wayne division to replace Mr. Saurer.

Mr. Saurer was born on November 10, 1890, at Orrville, Ohio, and graduated from Ohio Northern University in 1914 with a degree in civil engineering. His first railway service was with the Pennsylvania, with which road he became an assistant on the engineer corp at Ft. Wayne, Ind., on March 28, 1916. On November 1, 1923, he was promoted to assistant master carpenter on the Ft. Wayne division, with headquarters still at Ft. Wayne, where he remained until his recent promotion, effective June 1.

Obituary

J. W. Sweeney, supervisor on Subdivision No. 20 of the New York Central, with headquarters at Streator, Ill., died on May 23.

Fred Green, supervisor of track on the Akron division of the Baltimore & Ohio, with headquarters at Warren, Ohio, died at Akron, Ohio, on May 28. Mr. Green had been on leave of absence because of ill health since last November.

W. H. Adey, office engineer on the Delaware & Hudson, with headquarters at Albany, N. Y., died on May 17, at the age of 58 years.

F. G. Clements, supervisor of water service on the Missouri Pacific, with headquarters at Kansas City, Mo., died on June 5 at the Veterans' hospital in that city.

J. F. Winn, retired engineering inspector on the St. Louis-San Francisco, and formerly roadmaster on the Southern division of that road, died on April 26 at the age of 71 years.

B. V. Sommerville, assistant to the chief engineer of the Pennsylvania, with headquarters at Pittsburgh, Pa., died on June 7 at Easton, Pa., at the age of 67 years. Mr. Sommerville was born on October 30, 1862, near Bellefonte, Pa., and graduated from Lafayette College in 1885, with a degree in civil engineering. He commenced his railway career with the Pennsylvania on April 1, 1886, as a rodman in the engineering department of the Lines West of Pittsburgh (Pa.), with headquarters at

B. V. Sommerville

Pittsburgh. Five months later he was promoted to levelman and four months after that he was further promoted to transitman. On January 1, 1889, he was promoted to assistant engineer, maintenance of way of the Eastern division of the Northwest system of the Pennsylvania, with headquarters still at Pittsburgh. On May 1, 1897, he was transferred to the Panhandle division of the Southwest system, being then appointed a resident engineer on the Pittsburgh, Cincinnati, Chicago & St. Louis (part of the Pennsylvania) in March, 1900. On January 1, 1903, he was promoted to principal assistant engineer of the Southwest system and on July 1, 1916, he was made resident engineer of the Pennsylvania-Detroit Railroad (also part of the Pennsylvania). Mr. Sommerville was promoted to assistant to the chief engineer of the Pennsylvania on March 1, 1920, with headquarters at Detroit, Mich., and in 1925 he was transferred to Pittsburgh where he remained until his death.

Construction News

Projects Contemplated

C. R. I. & P. - S. L.-S. F.—Acting on petition of Ft. Worth & Denver Northern and civic organizations of Childress, Texas, and Pampa, the I. C. C. has opened for further argument the case in which it authorized subsidiaries of the C. R. I. & P. and S. L.-S. F. to construct 150 miles new lines in Texas, to establish shorter route to Ft. Worth, Texas, and Dallas.

Corpus Christi, San Angelo & Roswell—Charter filed with secretary of Texas for construction of line between Corpus Christi, Tex., and Roswell, N. M., 725 miles.

L. & N.—Permission requested of War Department to reconstruct bridge over Cumberland river, Nashville, Tenn., $220,000.

P. & L. E.—Construction of yard office building, McKee's Rocks, Pa., $40,000.

Sacramento Northern—Authority requested of I. C. C. to extend Holland line to Ryde, Cal., 8.3 miles.

S. P.—By Cal. Highway Com. to construct highway subways, Emigrant Gap, Cal., and Cottonwood.

Term. R. R. Assoc. of St. L.—Thirteen-story merchandise mart between 12th, 13th, Spruce and Poplar sts., St. Louis, Mo., $5,000,000.

Projects Authorized

B. & O.—Brick and steel outbound and inbound freight houses, 30 ft. by 500 ft., and 50 ft. by 620 ft. respectively, Toledo, Ohio, along Ottawa st.; also passenger and freight facilities, Johnstown, Ohio, to be moved to Baumer st., where brick passenger station and brick and steel freight house, 30 ft. by 305 ft. will be built.

Bangor & Aroostook—Alterations and additions to yard, Millinocket, Me., $100,000, and renewal and strengthening of 14 bridges, $134,000.

N. Y. N. H. & H.—Additional fire protection at shops, New Haven, Conn., $40,000.

Penna.—Razing present train sheds, construction umbrella sheds, lengthening present platforms and tracks, and additional smoke protection for structure over tracks, Union station, Columbus, Ohio, $750,00.

Ulster & Del.—Elimination grade crossing, East Main and Beaver sts., Stamford, N. Y., by construction of overpass.

Approved by Commissions

D. & H.—By Pub. Serv. Com. of N. Y. to close Vials crossing, Westport, by new overcrossing 375 ft. north, $128,000.

Erie—By Pub. Serv. Com. of N. Y. to eliminate Spring Valley-Suffern highway crossing, Ramapo, by construction of overpass 150 ft. west, $116,000.

N. Y. C.—By Pub. Serv. Com. of N. Y. to eliminate Butts crossing, Brighton, by construction of underpass; also elimination of Weedsport road crossing, Brutus, by construction of overpass, $178,000.

N. Y. N. H. & H.—By N. Y. Pub. Serv. Com. to widen to 60 ft., 30-ft. roadway on Scott's bridge carrying Lincoln ave. over tracks, Mt. Vernon, road's portion $45,400.

N. Y. O. & W.—By Pub. Serv. Com. of N. Y. to eliminate crossing at East Seneca st., Oswego, by construction of 400-ft. concrete and plate girder overhead bridge, $175,000.

Penna.—By Pub. Serv. Com. of N. Y. to eliminate Sand Hill crossing, Genesee Jct., N. Y., by construction of overhead crossing, $136,000.

St. L. S. W.—By I. C. C. to construct extension from Caraway, Ark., to Truman, to acquire Arkansas Short Line, and to operate under trackage rights over M. P. between Fair Oaks, Ark., and Bridge Junction, to form shorter route from St. Louis, Mo., to Memphis, Tenn.

Bids Received

A. T. & S. F.—Until June 11 by Los Angeles (Cal.) bd. of pub. wks. for construction subway at 6th st., Los Angeles.

C. P. R.—For construction freight sheds and offices, Humboldt, Sask., North Battleford and Prince Albert.

Cent. of Ga.—For construction warehouse and office building, Marion, Ga., $25,000.

C. R. I. & P.-Wab.—By. St. L. (Mo.) Bd. of Pub. Serv. for construction 3 bridges over depressed tracks, Forest Park, St. Louis, $145,500.

C. R. I. & P.-S. L.-S. F.—For construction concrete, brick, steel and stone union station, 222 ft. by 360 ft. Oklahoma City, Okla., $2,500,000.

City of Balt., Md.—By Dept. of Pub. Wks. for construction 1,933-ft. underpass on Eastern ave. under tracks of Penna. and B. & O.—Catalano & Pecora, Baltimore, $436,677.

Ky. & Ind. Term.—Until June 25 for excavation, embankment, masonry and steel work for elevation of tracks, adjustment of industrial siding connections and construction of underpass for six streets between Market and Kentucky sts., Louisville, Ky.

S. L.-S. F.—For construction extension, Shamrock, Okla., to Drumright, 3 miles.

Contracts Awarded

Albany (N. Y.) Port Dist. Com.—Construction 30,000 ft. track on Westerloo island—Henry Dumary, Albany, to connect main lines of West Shore and D. & H. with dock front.

Algoma Cent. & Hud. Bay—Construction two 40-ft. arches and 8 culverts, Sault Ste. Marie, Ont.—Robert Lang & Sons, Sault Ste. Marie, $40,000.

A. T. & S. F.—Extension, Amarillo, Tex., to Boise City, Okla., 120 miles, as part of Amarillo-Las Animas (Colo.) line—Sharpe & Fellows, Los Angeles, Cal.; also one-story, brick bunk houses, 14 ft. by 112 ft., Peabody, Kan., and Wilder—Lundgren & Carlson, Topeka, Kan.

Beav. Meade & Engl.—Construction of line, Hough, Okla., to Keyes, 40 miles—Panhandle Const. Co., Oklahoma City, Okla.

C. N. R.—By Dept. of Rys. and Canals of Can. for construction of 2,500,00-bu. grain elevator, Churchill, Man.—Carter-Halls-Aldinger Company, Winnipeg, Man.; construction of substructure of elevator—Thunder Bay Harbor Improvement Co., Port Arthur, Ont., $300,000, total cost $2,000,000.

C. & O.—Construction 1,000-ft. by 70-ft. coal pier of concrete on concrete piles, Newport News, Va.—W. Horace Williams Co., New Orleans, La.; also construction 6,300-ft., single-track tunnel between Big Bend, W. Va., and Hilldale—Haley, Chisholm & Morris, Charlottesville, Va., $2,200,000.

C. B. & Q.—New passenger and freight stations, Streator, Ill.—John Lightholder, Streator; and 900-ton reinforced concrete automatic electric coaling station, Galesburg, Ill.—Fairbanks, Morse & Co., Chicago.

C. M. St. P. & P.—By city of Sioux Falls, S. D., for construction 900-ft. reinforced concrete and steel viaduct over tracks of C. M. St. P. & P.; C. St. P. M. & O.; and G. N., Sioux Falls—Peppard & Fulton, Superior, Wis., $160,000.

C. R. I. & P.—Ten-stall addition to enginehouse, storehouse and enginehouse office all of brick, East Des Moines, Iowa—Athur H. Neumann, Des Moines, Iowa; also water-treating plant at same point—Railroad Water & Coal Handling Co., Chicago.

C. R. I. & P.—M. P.—Construction reinforced concrete viaduct over tracks and Rose creek, Little Rock, Ark.—Luten Bridge Co., Little Rock, $127,000.

Cin. (Ohio) Union Term.—Concrete masonry for new lines of C. & O. and C. N. O. & T. P. into terminal—Kerpen Const. Co., Cincinnati, $150,000.

E. J. & E.—Construction 330-ton, two-track coaling station with coal crushing facilities, Ingalton, Ill.—Roberts & Schaefer Co., Chicago.

Erie — Grade crossing elimination structure, Cleveland, Ohio—Stevens Const. Co., Cleveland; steel and concrete, two-story pier, 1,050 ft. by 70 ft., south of pier No. 9, Jersey City, N. J.—Frederick Snare Corp., New York.

I. C.—Reinforced concrete ice-loading platform, 14 ft. by 1,484 ft., Waterloo, Iowa—Zitterell-Mills Const. Co., Webster City, Iowa.

Ill. Term.—In connection with construction reinforced concrete and steel, elevated, double-track line, St. Louis, Mo., to connect surface line on 12th st. with McKinley bridge—steel fabrication, McClintic-Marshall Co., Pittsburgh, Pa.; steel erection, Ben Hur Erection Co., St. Louis; substructure for river pier, G. Locke Tarlton Co., St. Louis; river pier and temporary freight station and office building. Fruin-Colnon Contr. Co., St. Louis, total $1,500,000.

Maine Cent.—Additions to and reconstruction of wharves, Portland, Me.—Merritt-Chapman & Scott Corp., New York, $700,000.

M. P.—Two-story reinforced concrete warehouse, Kansas City, Mo.—Patti Const. Co., Kansas City, $50,000.

N. Y. C.—Elimination of Thompson road crossing, Syracuse, N. Y., by construction of viaduct—Bates & Rogers, New York, $420,000; elimination Main st. crossing, New Hamburg, N. Y.—Walsh Const. Co., Syracuse, N. Y., $42,329; canopies and other work for milk-handling, Weehawken, N. J.—Edward J. Duffy Co., Inc., New York; reconstruction bridge T-15, Blasdell, N. Y.—E. F. Muntz, Inc., Buffalo, N. Y.

N. Y. N. H. & H.—Installation of fire-protection system on Poughkeepsie bridge, Poughkeepsie, N. Y.—Foshett & Bishop Co., New Haven, Conn., $30,000.

Pac. Great East.—Grading for 5.2 miles of new line and yard, Lillooet, B. C.—W. C. Arnett, $100,000.

Penna.—Construction side track connection to Oakley factory colony, Cincinnati, Ohio, and for grading, masonry, paving, etc., from Allegheny River bridge to 20th st., Pittsburgh, Pa.—John F. Casey Co., Pittsburgh, Pa., $169,000 and $62,000; construction circular reinforced concrete coal pockets and auxiliary equipment at Gray's Ferry ave. and Alter st. and at 29th st. and Sedgley ave., Philadelphia, Pa.—Nicholson Co., Inc., New York, $185,000 and $38,000; placing deck slabs on bridges Nos. 4.21 and 4.25 over Hackensack river, Marion, N. J.—Frederick Snare Corp., New York, $148,400; construction wye track between Cincinnati and Logansport divisions and reconstruction bridge over Mississinewa river, Ridgeville, Ind.—Mellon Const. Co., Chicago, total cost $85,000; for construction overcrossing and undergrade pedestrian subway, Seward, Pa.—Ferguson & Edmonson Co., Pittsburgh, $62,000; construction Pier F of steel and concrete at foot of Bay st., Jersey City, N. J.—J. Rich Steers, Inc., New York.

Pere Marq.—Substructure for two fixed spans and one movable span for steel bridge, Port Huron, Mich.—Jutton Kelly Co., Detroit, Mich.; fabrication and erection superstructure—American Bridge Co., New York; total cost of bridge, $500,000.

P. & W. V.—Construction 6 miles line from point on Connellsville extension near Pigeon creek to connection with Donora Southern, Baird, Pa.—Vang Construction Co., Cumberland, Md., $1,500,000.

St. L. S. W.—Grading for line, Truman, Ark., to Caraway, 15 miles—Reid & Lowe, Birmingham, Ala.

Sou.—Water treating plant, Shelbyville, Ky.—R. D. Cole Manu. Co., Newman, Ga.

U. P.—Construction concrete lined reservoir, Hanna, Wyo.—Ryberg Bros., Salt Lake City, Utah, and Morrison Knudson Co., Boise, Idaho.

Virginian.—Sections A and B of new bridge over Kanawha river, Deepwater, W. Va.—Boxley Bros. Co., Inc., Orange, Va.

Va. & W.—Seven miles new line, M. P. 26 to M. P. 33, Guyandot River line from Elmore, W. Va., to Gilbert—Walton Ludduth Company, Bluefield, W. Va.

Supply Trade News

General

The Morrison Railway Supply Corporation, Buffalo, N. Y., has moved its Chicago offices to 650 Railway Exchange building.

The **Ash Grove Lime & Portland Cement Company,** Kansas City, Mo., has moved its general offices in that city to the Fairfax building, 101 West Eleventh Street.

The Independent Penumatic Tool Company, Chicago, has purchased the **Cochise Rock Drill Manufacturing Company,** Los Angeles, Cal., which will be operated by the former company as a unit of its organization, with no change in personnel.

The Valspar Corporation, New York, has merged the **Detroit Graphite Company,** Detroit, Mich., and the **Dominion Paint Works, Ltd.,** Walkerville, Ont., with its existing units. The plans for consolidating the activities of the two companies with the other units of the Valspar Corporation do not contemplate any change in management or loss of identity in these two new subsidiaries.

The **American Tar Products Company,** Pittsburgh, Pa., has acquired the **Ayers & Lord Tie Company,** Chicago. All of the officers of the latter company will continue in their present capacities and the company will be operated as a separate unit of the controlling company. The Ayer & Lord company now operates timber treating plants at Carbondale, Ill., Louisville, Ky., North Little Rock, Ark., Grenada, Miss., and Montgomery, Ala., a tie storage plant at Brookport, Ill., marine ways at Paducah, Ky., and a creosote oil station at New Orleans, La.

The Blaw-Knox International Corporation is the new name for the export organization of the **Blaw-Knox Company,** which was formerly known as the Milliken Brothers-Blaw-Knox Corporation, which in turn succeeded the original Milliken Brothers Manufacturing Company. The change of name embraces no change in personnel and the offices will remain as formerly, in the Canadian-Pacific building, New York City. The Blaw-Knox International Corporation handles all the products of the Blaw-Knox Company in South America, the West Indies and other parts of the world where the Blaw-Knox Company is not otherwise represented.

Personal

T. A. Burns has joined the sales organization of the **Harnischfeger Corporation,** Milwaukee, Wis., with headquarters in that city.

W. L. Lewis, formerly assistant comptroller of the **Bethlehem Steel Corporation,** has been elected vice-president, secretary and treasurer of the **Chicago Pneumatic Tool Company,** New York, succeeding J. G. Grimshaw, secretary and treasurer, resigned.

James J. Crawford has been appointed representative of the Railway Appliance division of the **American Fork & Hoe Company,** with headquarters in Louisville, Ky.

H. S. Schroeder, formerly vice-president and general sales manager of the **Interstate Iron & Steel Company,** has been appointed western manager of sales for the **Republic Steel Corporation,** with headquarters at Chicago.

J. L. Rowe, manager of railroad sales of the Chicago Pneumatic Tool Company, New York, died on June 5 from injuries sustained in an automobile accident. Mr. Rowe has been with the company since 1919.

A. L. Greenabaum, vice-president of the O. F. Jordan Company, East Chicago, Ind., died at Chicago on June 4 after an extended illness. Mr. Greenabaum was born on January 20, 1880, at

A. L. Greenabaum

Wilmington, Del., and served in the navy during the Spanish American War. He also worked for various construction contractors and for a time was in this business for himself. In 1914 he entered the service of the Chicago, Rock Island & Pacific and was subsequently advanced to supervisor of work equipment and motor cars of that road. On September 15, 1920, Mr. Greenabaum left the Rock Island to become general sales manager of the O. F. Jordan Company, and in 1928 he was promoted to vice-president of that company, which position he held until his death. Mr. Greenabaum was also prominent in the affairs of the National Railway Appliances Association and was a past-president of that organization.

I. N. Benson, general supervisor of work equipment on the Boston & Maine, with headquarters at Boston, and who for 16 years has been connected with the New York, New Haven & Hartford and the Boston & Maine

in charge of work equipment, has been appointed development engineer of railroad equipment of the Bucyrus-Erie Company, with headquarters at South Milwaukee, Wis.

Russell B. Arnold, 140 South Dearborn street, Chicago, has been appointed mid-west sales representative of the **Howard P. Cook Company,** Bridgeport, Conn., to handle the Greer snow melting devices.

Elmer A. Sperry, inventor of the Sperry transverse fissure detector car and one of the foremost American engineers and inventors, died on June 16 at

Elmer A. Sperry

Brooklyn, N. Y., at the age of 70 years. Mr. Sperry was born on October 12, 1860, at Cortland, N. Y., and was educated at the State Normal School in that city, subsequently attending Cornell University for a year. He engaged in business and invention at an early age and was immediately successful. He founded the Sperry Electric Company of Chicago and the Sperry Electric Railway Company, Cleveland, Ohio, selling the latter company to the General Electric Company in 1894. His work from then on included improvements in mining machinery, electrical equipment, street railway cars, inventions in the field of electro-chemistry, the practical application of the gyroscope to steamships, the gyro-compress, drift indicators, gun-fire control apparatus, bomb-sighting devices and many other appliances. In 1929, Mr. Sperry started the Sperry Development Company, Inc., and the Sperry Rail Service Corporation. Later he organized the Sperry Products, Inc., as successor to the two last-named companies. Mr. Sperry was a member of many technical societies and the recipient of various medals in recognition of his many inventions.

William E. Balliet has been appointed manager of the Birmingham, Ala., office of the **Blaw-Knox Company,** Pittsburgh, Pa., to succeed **P. V. Kelly,** and **Joseph Riley** has been appointed assistant manager of the district. **John E. Chiquoine** has joined the sales staff of this company.

A. H. Purdom has resigned from the railroad sales department of the **Wood Conversion Company,** Chicago, and will open an office to handle railway supplies. **Benjamin B. Shaw** has been appointed sales representative in the railroad department, with headquarters at Chicago.

George H. Lanborn, formerly production manager of the Chicago plant of the **Morrison Railway Supply Corporation,** Buffalo, N. Y., has been appointed supervising engineer of the manganese frog and crossing reconditioning department of that company, with headquarters at Chicago. **R. B. Alfonte** has been appointed assistant to the manager of the Chicago office.

G. F. Blackmer, general superintendent, and **J. A. Coakley,** general traffic manager of the **American Steel & Wire Company,** have been appointed vice-presidents, with headquarters at Cleveland, Ohio. **B. H. Lawrence,** mechanical engineer, has been promoted to chief engineer at Cleveland, and **Frank Baaches,** vice-president at Chicago, has been appointed assistant to the president.

Trade Publications

Rock-Drill Steel.—The Sullivan Machinery Company, Chicago, has published a 48-page handbook, designated as circular No. 72-K, which contains valuable information on the selection, heating, forging and tempering of rock-drill steel. It also includes instructions for the care and use of Sullivan drill sharpeners and drill-steel furnaces.

Quarry Cars and Track Material.—The Koppel Industrial Car & Equipment Co., Koppel, Pa., has issued a 32-page booklet, which is devoted to illustrating and describing the various types of quarry cars that are manufactured by this company. Space is also given to a description of metal ties, switches, turntables and other track material which is distributed by this company.

Hayward Buckets.—The Hayward Company, New York, has recently issued Bulletins No. 645 and No. 700, which describe and illustrate products of this company. The former deals with the Class K clam shell bucket and, besides describing the bucket, depicts its various applications by illustrations. The latter bulletin contains a description of the Hayward electric motor bucket, which is a "hook-on" type of clam shell bucket that can be hooked on to any standard form of crane.

Beginning the Second Century.—This is the title of a 20-page, colorfully-illustrated booklet containing a condensed and intensely interesting history of Fairbanks, Morse & Co., Chicago. The development of the Fairbanks scale, which was invented in 1830, is dealt with first and is followed by a discussion of the circumstances leading up to the organization of Fairbanks, Morse & Co. A chapter is devoted to the history of power and the Diesel engine and the booklet closes with a chapter describing the part which Fairbanks scales play in modern industry.

Personal Mention

General

F. J. Nugent, division engineer on the Iowa division of the Chicago, Rock Island & Pacific, with headquarters at Des Moines, Iowa, has been promoted to trainmaster, with the same headquarters. He was born on April 15, 1878, at Waterloo, Iowa, and graduated from the University of Iowa with a degree in civil engineering in 1903. Mr. Nugent's railway career began with the Rock Island in 1903, when he became a material clerk at Silvis, Ill. Later he was transferred to the engineering and maintenance of way departments, being appointed roadmaster at Cedar Rapids, Iowa, in 1909. Later in that year Mr. Nugent was appointed assistant engineer with the same headquarters and in 1910 he was placed in charge of the construction of a yard at Cedar Rapids. In 1911, he was promoted to office engineer, with headquarters at Chicago, and on February 1, 1912, was sent to Little Rock, Ark., as division engineer. He then served as division engineer and office engineer on various divisions of the Rock Island, being subsequently appointed division engineer on the Iowa division, which position he held until his recent promotion, effective May 1.

J. K. Johnston, formerly principal assistant engineer on the Pennsylvania and more recently assistant general superintendent of the Eastern Pennsylvania division of that road, with headquarters at Tyrone, Pa., retired from active service on June 1. Mr. Johnston, who had served continuously for nearly 51 years with the Pennsyl-

J. K. Johnston

vania, was born on May 8, 1860, at Pleasant Unity, Westmoreland County, Pa. After graduating from Greensburg Academy he commenced his railway career in August, 1879, with the engineering department of the Pennsylvania on the location and construction of branch lines in southwestern Pennsylvania. In January, 1887, he was promoted to assistant engineer maintenance of way, with headquarters at Altoona, Pa., and on July 31, 1888, he

was appointed assistant supervisor on the Tyrone division. On November 1, 1902, Mr. Johnston was promoted to principal assistant engineer at Altoona, then being further promoted to superintendent of the Tyrone division, with headquarters at Tyrone, the following year. He was transferred to the Philadelphia division, with headquarters at Harrisburg, Pa., in October, 1917, returning to Tyrone as superintendent in February, 1928. Following the absorption of the Tyrone division by the Williamsport and Middle divisions on May 1, 1929, Mr. Johnston was appointed assistant general superintendent of the Eastern Pennsylvania division, which position he was holding at the time of his retirement.

F. D. Beale, an engineer by training and experience and superintendent of the Richmond division of the Chesapeake & Ohio, with headquarters at Richmond, Va., has been promoted to assistant general superintendent of the Western General division, a newly created position, with headquarters at Huntington, W. Va. Mr. Beale was born in 1890, at Fredericksburg, Va., and first entered railway service in January, 1910, with the Florida Railway (now abandoned) where he served as instrumentman, assistant engineer and resident engineer until September, 1911, when he resigned to enter the University of Virginia, from which he graduated four years later with a degree in civil engineering. He commenced his service with the C. & O. in October, 1915, as an assistant track foreman, being promoted to assistant supervisor of track a year later. He was appointed acting division engineer of the Clifton Forge division in May, 1917, later being promoted to division engineer of the same division. After a period of service in the United States Army during the World War, he returned to the position of division engineer of the Clifton Forge division. In February, 1924, Mr Beale entered the operating department as trainmaster, in which position he served on various divisions until March, 1926, when he was promoted to superintendent of the Richmond division, which position he held until his recent promotion to assistant general superintendent.

Engineering

C. A. Stelle, resident engineer on the Chicago & Alton, with headquarters at Chicago, has resigned.

F. R. Baldwin, assistant engineer on the Atchison, Tokepa & Santa Fe, with headquarters at Chicago, has been promoted to engineer of inventories, with the same headquarters.

I. Anderson, division engineer of the Kansas City division of the Atchison, Topeka & Santa Fe, with headquarters at Kansas City, Mo., has moved to the Argentine station, Kansas City, Kan. **E. O. Hemenway,** assistant engineer with headquarters at Chicago, has been appointed acting division engineer of the Illinois division, with headquarters at Chillicothe, Ill., to replace **T. H. McKibben,** who has been assigned to special valuation work.

A. L. Zimmerman, assistant engineer on the International-Great Northern, with headquarters at San Antonio, Tex., has been transferred in the same capacity to Houston, Tex.

L. G. Harris, construction engineer on the Coast Lines of the Atchison, Topeka & Santa Fe, has been promoted to district engineer of the Northern district of the Western Lines, with headquarters at La Junta, Colo., to succeed **D. E. Helvern,** who has been appointed division engineer at Pueblo, Colo., where he succeeds **O. F. Arthur,** who has been transferred to Albuquerque, N. M.

L. G. Harris

Mr. Harris was born on August 27, 1886, at Parsons, Kan., and commenced his railway career in October, 1905, as a chainman on the A. T. & S. F. at Canyon, Tex. He was then advanced through various positions in the engineering department, including that of rodman, transitman and building inspector, serving in the latter capacity on maintenance, construction and betterment work and on location surveys. In January, 1916, he was appointed acting division engineer of the Arkansas River division, being then, in the spring of 1917, promoted to division engineer of the Rio Grande division, with headquarters at San Marcial, N. M. Mr. Harris was subsequently appointed construction engineer on the Coast Lines, serving on various projects there until his recent promotion to district engineer.

R. M. Smith, assistant engineer maintenance of way on the Missouri Pacific, with headquarters at St. Louis, Mo., has been appointed division engineer of the new Southern Kansas-Central division, with headquarters at Coffeyville, Kan. The Southern Kansas-Central division was formed on June 1 by consolidating the Southern Kansas and the Central divisions. **W. F. Murray,** division engineer of the former Southern Kansas division, with headquarters at Coffeyville, has been appointed assistant division engineer of the new division, with jurisdiction over the territory of the former Central division and with headquarters at Van Buren, Ark. **C. B. Huffman,** division engineer of the former Central division at Van Buren, has been appointed assistant engineer on the Omaha-Northern Kansas division, with headquarters at Falls City, Neb., to replace **L. L. Swim,** who has been transferred to the Southern Kansas-Central division at Coffeyville. **H. H. Heasley,** assistant engineer on the former Southern Kansas division at Coffeyville, has been transferred to the Memphis division, with headquarters at Wynne, Ark., where he succeeds **A. A. Glockner,** who has been assigned to other duties.

R. E. Sherer, assistant engineer on the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Enderlin, N. D., has been promoted to division engineer of the Twin City Terminal division, with headquarters at Minneapolis, Minn., to replace **S. P. Berg,** who has been transferred to the Stevens Point division, with headquarters at Stevens Point, Wis., where he succeeds **E. E. Foster,** whose appointment as resident engineer at Minneapolis was noted in the June issue. **W. M. Olds,** assistant engineer, with headquarters at Fond du Lac, Wis., has been transferred to Enderlin to replace Mr. Sherer.

R. A. Brown, instrumentman on the Illinois division of the Chicago, Rock Island & Pacific, has been promoted to division engineer on the Cedar Rapids-Minnesota division, with headquarters at Cedar Rapids, Iowa, to succeed **W. E. Heimerdinger,** who has been transferred to the Iowa division, with headquarters at Des Moines, Iowa, to replace **F. J. Nugent,** whose promotion to train master is noted elsewhere in these columns.

Mr. Brown was born on February 15, 1902, in Kent county, Mich., and graduated from the University of Michigan in 1924 with a degree in civil engineering. He commenced his railway career in the same year as a rodman on the Cedar Rapids-Minnesota division of the Rock Island and has since been with that road continuously. In 1925, he was promoted to rodman on the survey of the proposed line of the Rock Island from Trenton, Mo., to Kansas City. On the completion of this survey Mr. Brown resumed his former position on the C. R.-M. division, where he remained until September, 1925, when he was again promoted to rodman, this time on the Iowa division. A year later he was transferred to Chicago and on March 1, 1926, he was promoted to instrumentman on the Missouri division, being then transferred to the Illinois division, where he remained until his recent promotion, effective May 1.

Track

W. W. Clarke, acting supervisor of track on the Pennsylvania, with headquarters at Marion, Ohio, has been promoted to supervisor with the same headquarters.

Michael Clarke, assistant roadmaster on the Louisville & Nashville, with headquarters at Athens, Ala., retired

on May 1 after 54 years of active service with that road.

Thomas Stewart, supervisor of track of Subdivision No. 1 of the Grand Rapids division of the Pennsylvania, with headquarters at Kalamazoo, Mich., retired on June 1 at the age of 70 years.

Alexander Hallisey has been appointed roadmaster on the Southern Pacific with headquarters at Suisun, Cal., to succeed **C. N. Myrick,** whose transfer to Niles, Cal., was noted in the June issue.

M. Ganley, roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Argentine, Kan., has been transferred to Topeka, Kan., to replace **J. O. Abramson,** who is on leave of absence on account of illness.

C. L. Nolan has been appointed supervisor of track on Sub-division No. 20 of the New York Central, with headquarters at Streator, Ill., to succeed **J. W. Sweeney,** whose death is noted elsewhere in these columns.

H. Hill, supervisor on the Cresson branch of the Pittsburgh division of the Pennsylvania, with headquarters at Cresson, Pa., has been appointed assistant supervisor on the same division with headquarters at Johnstown, Pa., to succeed **D. M. Clarke,** resigned.

S. A. Hart, supervisor on Subdivision No. 3 of the Long Island, with headquarters at Jamaica, N. Y., has been transferred to Subdivision No. 5, at Hicksville, N. Y., succeeding **H. W. Manning,** who has been transferred to Jamaica to succeed Mr. Hart.

Melvin L. Doyle, acting supervisor of track on the Akron division of the Baltimore & Ohio, with headquarters at Warren, Ohio, has been promoted to supervisor of track, with the same headquarters, to succeed **Fred Green,** who has been on leave of absence and whose death is noted elsewhere on this page.

M. Snodgrass, supervisor of track on the Illinois Central, with headquarters at Evansville, Ind., has been assigned to other duties. The territory formerly alloted to Mr. Snodgrass has been divided between **M. A. Sheahan** and **M. B. Davis,** supervisors, with headquarters at Decatur, Ill., and Mattoon, respectively. **I. D. Holmes,** supervisor with headquarters at Mendenhall, Miss., has been transferred to Durant, Miss., where he replaces **W. E. McCune,** who is on leave of absence. The position of supervisor at Mendenhall has been abolished.

T. Dixon, track foreman on the Canadian National, with headquarters at Estevan, Sask., has been promoted to roadmaster on the Regina division, with headquarters at Radville, Sask., to succeed **T. J. Patton,** who has been transferred to the Beechy, Elrose and White Bear subdivisions of the Saskatoon division to replace **C. F. Werseen.** Mr. Werseen has been transferred to Saskatoon, Sask., on the same division to succeed **W. M. Carroll,** retired. **A. E. Lyons,** roadmaster at Swan River, Man., has been transferred to Sioux Lookout, Ont., where he succeeds **R. Ferguson,** who has retired. **A. Shack** roadmaster at Melville, Sask., has been transferred to Saskatoon to replace **G. T. Bell,** also retired.

G. W. Clark, track foreman on the Western Pacific, with headquarters at Redhouse, Nev., has been appointed roadmaster on the Tidewater Southern, with headquarters at Modesto, Cal. Mr. Clark was born on March 20, 1893, at Grantsville, Utah, and was educated at the University of Utah and George Washington Medical College, Washington, D. C. He commenced his railway career on October 28, 1924, as a timekeeper in the engineering department of the Western Pacific, with headquarters at Timpie Quarry, Utah, being transferred to the bridge and building department on July 5, 1925, and thence to the maintenance of way department on March 1, 1926. On May 6 of the same year, Mr. Clark was appointed bridge and building and roadmasters' clerk at Elko, Nev., and on September 12, 1927, he was appointed shop accountant with the same headquarters. On March 16, 1928, he was transferred back to the maintenance of way department as a track man in the Elko yards, and on April 16 of the same year he was promoted to track foreman at Redhouse.

Bridge and Building

T. E. Downard, supervisor of bridges and buildings on the Gulf & Ship Island division of the Illinois Central, with headquarters at Hattiesburg, Miss., has been transferred to the Kentucky division with headquarters at Louisville, Ky.

D. E. Saurer, assistant master carpenter on the Ft. Wayne division of the Pennsylvania, has been appointed master carpenter on the Chicago Terminal division, with headquarters at Chicago, to succeed **A. F. Miller,** retired. **H. R. Morris,** carpenter foreman on the Indianapolis division, has been promoted to assistant master carpenter on the Ft. Wayne division to replace Mr. Saurer.

Mr. Saurer was born on November 10, 1890, at Orrville, Ohio, and graduated from Ohio Northern University in 1914 with a degree in civil engineering. His first railway service was with the Pennsylvania, with which road he became an assistant on the engineer corp at Ft. Wayne, Ind., on March 28, 1916. On November 1, 1923, he was promoted to assistant master carpenter on the Ft. Wayne division, with headquarters still at Ft. Wayne, where he remained until his recent promotion, effective June 1.

Obituary

J. W. Sweeney, supervisor on Subdivision No. 20 of the New York Central, with headquarters at Streator, Ill., died on May 23.

Fred Green, supervisor of track on the Akron division of the Baltimore & Ohio, with headquarters at Warren, Ohio, died at Akron, Ohio, on May 28. Mr. Green had been on leave of absence because of ill health since last November.

W. H. Adey, office engineer on the Delaware & Hudson, with headquarters at Albany, N. Y., died on May 17, at the age of 58 years.

F. G. Clements, supervisor of water service on the Missouri Pacific, with headquarters at Kansas City, Mo., died on June 5 at the Veterans' hospital in that city.

J. F. Winn, retired engineering inspector on the St. Louis-San Francisco, and formerly roadmaster on the Southern division of that road, died on April 26 at the age of 71 years.

B. V. Sommerville, assistant to the chief engineer of the Pennsylvania, with headquarters at Pittsburgh, Pa., died on June 7 at Easton, Pa., at the age of 67 years. Mr. Sommerville was born on October 30, 1862, near Bellefonte, Pa., and graduated from Lafayette College in 1885, with a degree in civil engineering. He commenced his railway career with the Pennsylvania on April 1, 1886, as a rodman in the engineering department of the Lines West of Pittsburgh (Pa.), with headquarters at

B. V. Sommerville

Pittsburgh. Five months later he was promoted to levelman and four months after that he was further promoted to transitman. On January 1, 1889, he was promoted to assistant engineer, maintenance of way of the Eastern division of the Northwest system of the Pennsylvania, with headquarters still at Pittsburgh. On May 1, 1897, he was transferred to the Panhandle division of the Southwest system, being then appointed a resident engineer on the Pittsburgh, Cincinnati, Chicago & St. Louis (part of the Pennsylvania) in March, 1900. On January 1, 1903, he was promoted to principal assistant engineer of the Southwest system and on July 1, 1916, he was made resident engineer of the Pennsylvania-Detroit Railroad (also part of the Pennsylvania). Mr. Sommerville was promoted to assistant to the chief engineer of the Pennsylvania on March 1, 1920, with headquarters at Detroit, Mich., and in 1925 he was transferred to Pittsburgh where he remained until his death.

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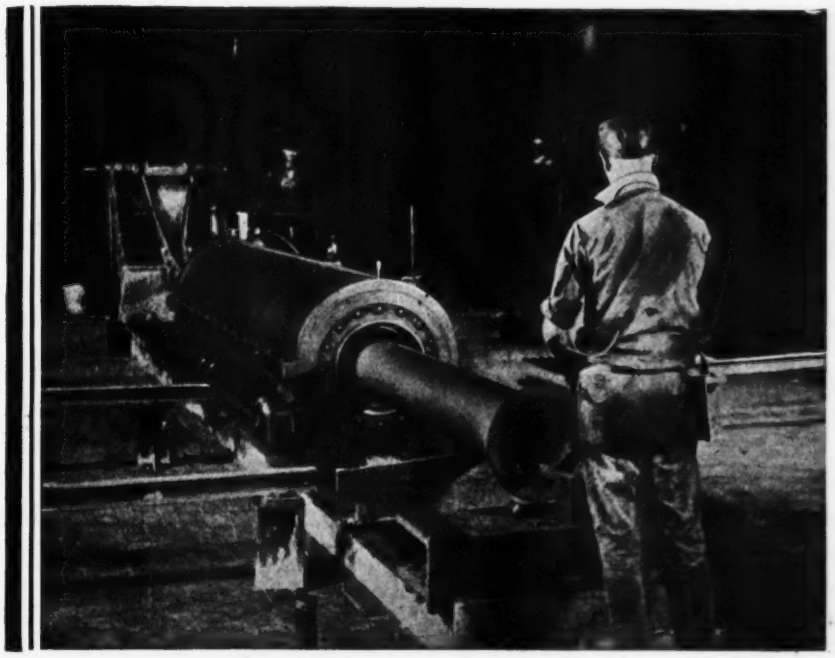

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Windshields
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.

Wire Fencing
American Steel & Wire Co.
Anchor Post Fence Co.
Bethlehem Steel Co.
Page Fence Association

Wire, Welding
Oxweld Railroad Service Co.

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See Preservation, Timber

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